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SELECT COMMITTEE ON THE SYSTEM OF DEEP WELL BORING

REPORT

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REPORT

OF THE

SELECT COMMITTEE

ON THE

System of Deep Well Boring

AND THE

Use of Diamond Drills.

Printed by Order of the Legislative Council.

JULY, 1903.

CAPE TOWN:
"CAPE TIMES" LIMITED, KEEROM STREET
1903

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C 1. 1903.—DIAMOND DRILLS AND DEEP WELL BORING.

ORDERS APPOINTING COMMITTEE.

16th June, 1903.

ORDERED : That a Select Committee be appointed to inquire into and report upon the system of deep-well boring and the use of diamond drills ; the Committee to consist of Messrs. de Smidt, Maasdorp, Ross, van den Heever, Wilmot, du Toit, and Logan, with power to take evidence and call for papers.

ORDERED : That the evidence taken by the Select Committee on diamond drills and deep-well boring, appointed by the Legislative Council during the Session of 1899, be laid upon the Table, and that it be referred to the Select Committee on deep-well boring and diamond drills appointed by the Council this day.

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REPORT

OF THE

SELECT COMMITTEE, appointed by Order of the Legislative Council, dated the 16th June, 1903, to inquire into and report upon the system of Deep-Well Boring and the use of Diamond Drills, the Committee to consist of Messrs. DE SMIDT, MAASDORP, ROSS, VAN DEN HEEVER, WILMOT, DU TOIT, and LOGAN, with power to take evidence and call for papers.

Your Committee beg to report that the evidence given clearly shows the great advantages farmers and others derive from the use of diamond and other drills, and also the indirect benefit which naturally accrues to the country at large in consequence.

This Committee recommends that drills capable of boring in soft formation should (wherever practicable) be of 6 inch diameter, and in the harder formation of 4 inch diameter, the object being to enable a much larger volume of water to rise or be pumped to the surface as the case may be.

Your Committee are further of opinion that the present system of charges to farmers and others hiring drills is very unsatisfactory, and as the Commissioner of Public Works has stated in evidence that Government practically pay two-thirds of the cost of boring, and his and other evidence go to prove conclusively that the average cost of boring is £1 per foot, they suggest that the Government should take into consideration the question ot framing a new scale of charges in lieu of the present complicated system on the following basis, namely, that the farmer or other person hiring the drill pay at least one-third of the cost, and not more than one-half, such charge not to exceed 10s. per foot up to a depth of 500 feet, and that the hirer's liability should commence and end there.

From the evidence before the Committee it is clearly proved that the number of drills possessed by the Government at the present time is altogether inadequate, and they strongly recommend that the Government should take into consideration the urgent necessity that exists for very largely increasing the number at an early date, and that, as this question of water-boring is in their opinion of such importance to the country at large, the Government should take into consideration the advisability of making sufficient provision on this year's Supplementary Estimates for purchasing additional drills.

The number of applications for boring already in arrear exceed 1000, and for the purpose of working off such applications, your Committee recommend that it would be advisable that contracts should be entered into with individuals or firms who are prepared to undertake such work, thereby greatly expediting this matter in the most practicable way.

Your Committee are further of opinion that tracings of the sections of the various cores taken from bore holes should be carefully made and preserved by the Government, which would be of the greatest assistance in future when framing a geological survey of the country; and the Committee would also suggest that the services of a competent geologist, with a knowledge of water finding, and with Colonial experience if possible, are highly desirable in connection with this Branch of the Government Service and would materially assist in carrying out the recommendations of the Committee.

In conclusion your Committee cannot too strongly impress upon the Government the great benefits to be derived from this important work, and they earnestly trust that their recommendations will receive that serious consideration from the Government which they consider absolutely imperative.

JAMES D. LOGAN,
Chairman.

Legislative Council,
Committee Rooms,
30th July, 1903.

HET RAPPORT

VAN HET

SELECT COMITE aangesteld op last van den Wetgevenden Raad, den 16den Juni, 1903, om onderzoek te doen naar en rapport te doen over het stelsel van het boren van diepe putten en het gebruik van Diamanten Drilboren. Het Comité te bestaan uit de heeren DE SMIDT, MAASDORP, ROSS, VAN DEN HEEVER, WILMOT, DU TOIT, en LOGAN, met macht om getuigenis in te winnen, en om papieren te vragen.

Uw Comité wenscht te rapporteeren, dat de gegeven getuigenis duidelijk de voordeelen aantoont, die boeren en anderen uit het gebruik van diamanten en anderen drilboren genieten en ook het indirekt nut, dat natuurlijk, diensvolgens het land in het algemeen toevloeit. Het Comité beveelt aan, dat drilboren, geschikt in zachte formaties te boren, een middellijn van 6 duim (alwaar ook uitvoerbaar) hebben zullen en dezulke voor de harde formaties geschikt, een middellijn van 4 duim zullen hebben het oogmerk daarvan zijnde een veel grooter massa water in staat te stellen naar de oppervlakte te rijzen of gepompt te worden, zooals het geval moge zijn.

Het Comité is ook verder van oordeel dat het tegenwoordige prijstarief voor boeren en anderen, die drilboren huren zeer onbevredigend is, en daar de Commissaris van Publieke Werken in zijn getuigenis gezegd heeft, dat het Gouvernement feitelijk twee-derden van de kosten van het boren betaalt en daar zijn getuigenis en die van anderen een overtuigend bewijs is dat de gemiddelde kosten van boren £1 per voet is, geeft het Comité aan de hand, dat het Gouvernement in overweging zal nemen een nieuw prijstarief op te trekken, in plaats van het tegenwoordige ingewikkelde stelsel en wel op de volgende basis, namelijk dat de boer of andere persoon, die de drilboor huurt, ten minste een derde van de kosten en niet meer dan eene helft zal betalen, zoodanige betaling niet te boven gaande 10s. per voet, tot een diepte van 500 voet, en dat de verantwoordelijkheid van de huurders daar zullen beginnen en eindigen.

De getuigenis door het Comité ingewonnen, bewijst duidelijk dat het aantal drilboren thans in bezit van het Gouvernement, geheel en al onvoldoende is en het beveelt ten sterkste aan dat het Gouvernement de dringende noodzakelijkheid, die er bestaat, in overweging nemen zal, van, op een vroegen datum, het getal boren aanmerkelijk te vermeerderen, en dat, daar deze kwestie van boren naar water in zijn oordeel, van zoo groot gewicht is voor het land in het algemeen, behoort het Gouvernement de wenschelijkheid in overweging te nemen van een genoegzame voorziening te maken in de Supplementaire Begrooting van dit jaar, ten einde additioneele drilboren te koopen.

Het aantal achterstallige applicaties, voor naar water te boren, gaat reeds 1000 te boven en met het doel om zoodanige applicaties uit te voeren, beveelt het Comité aan dat het wenschelijk zijn zal, indien uitvoerbaar, dat contracten aangegaan zullen worden met personen of firmas, die bereid zijn zoodanig werk te ondernemen, waardoor deze zaak op de meest practische wijze zal worden vergemakkelijkt.

Uw Comité is verder van gevoelen, dat teekeningen van de secties van de verschillende binnenste steenen van boorgaten genomen, zorgvuldig zullen worden gemaakt en door het Gouvernement bewaard, die in de toekomst van de grootste hulp zijn zal in het optrekken van een Geologische opmeting van het land ; en het Comité beveelt ook aan, dat de diensten van een bevoegden Geoloog, met kennis van water te vinden en met Koloniale ondervinding, indien mogelijk, zeer wenschelijk zullen zijn in verband met dezen tak van Gouvernements dienst en grootelijks helpen zullen, om de aanbevelingen van het Comité uit te voeren.

Ten besluite, kan het Comité het Gouvernement niet te sterk op het gemoed drukken, de groote voordeelen die van dit belangrijk werk verkregen kunnen worden en het ernstig vertrouwen, dat zijn recommendaties, die ernstige overweging van het Gouvernement genieten zullen, die het absoluut imperatief noodzakelijk beschouwt.

PROCEEDINGS OF COMMITTEE.

PROCEEDINGS OF THE SELECT COMMITTEE, appointed by Order of the Legislative Council, dated the 16th June, 1903, to enquire into and report upon the System of Deep Well Boring and the use of Diamond Drills, the Committee to consist of Messrs. DE SMIDT, MAASDORP, ROSS, VAN DEN HEEVER, WILMOT, DU TOIT and LOGAN, with power to take evidence and call for papers.

Tuesday, 23rd June, 1903.

PRESENT :

Mr. du Toit.	Mr. Ross.
Mr. Logan.	Mr. Wilmot.
Mr. Maasdorp.	Mr. van den Heever.

The Clerk read the Order of Council dated the 16th instant appointing Committee, also the Order of Council referring the Evidence taken by Select Committee in 1899 to this Committee.

Resolved : That Mr. Logan be Chairman of this Committee.

The Clerk laid upon the Table Proceedings and Evidence of the Select Committee on Diamond Drills and Water Boring appointed by the Council on the 10th August, 1899.

Committee in deliberation.

Resolved : That the evidence and annexure taken before the Select Committee of 1899 be printed as an appendix to the proceedings of this Committee. [Appendix A.]

Resolved : To examine the Honourable the Commissioner of Public Works ; Mr. B. W. Ritso, Inspector of boring ; and Mr. Mackechnie, foreman inspector of boring.

Committee adjourned until 10 30 Thursday, 25th June, 1903.

Thursday, 25th June, 1903.

PRESENT :

MR. LOGAN (in the Chair.)

Mr. Ross.	Mr. Wilmot.
Mr. Maasdorp.	Mr. van den Heever.
Mr. de Smidt.	Mr. du Toit.

Minutes of former Meeting read and confirmed.

The Commissioner of Public Works examined.

Mr. B. W. Ritso, inspector of boring, examined.

The Clerk laid upon the Table Government Notice, No. 837*, 1902, Rules and Regulations for the Hire of Government Water Drills.

The Committee in deliberation.

Resolved : That Mr. B. W. Ritso, Inspector of boring, be re-examined ; and that Mr. Mackechnie, foreman inspector of boring, be examined at the next meeting.

The Committee adjourned until 30th June, 1903.

Tuesday, 30th June, 1903.

PRESENT :

MR. J. D. LOGAN (in the Chair.)

Mr. Ross.	Mr. van den Heever.
Mr. de Smidt.	Mr. du Toit.
Mr. Maasdorp.	Mr. Wilmot.

Minutes of last Meeting read and confirmed.

Mr. W. B. Ritso examined.

Return, Estimated Cost of Drills, put in. Annexure B.

Mr. Mackechnie examined.

Committee in deliberation.

Committee adjourned until Tuesday, the 21st July, 1903.

Tuesday, 21st July, 1903.

PRESENT :

MR. LOGAN (in the Chair.)

Mr. de Smidt.	Mr. du Toit.
Mr. van den Heever.	Mr. Wilmot.

Minutes of previous Meeting read and confirmed.

Committe in deliberation.

Resolved : That the evidence of Hon. Mr. Logan be taken and that Mr. du Toit take the Chair.

The Chairman left the Chair.

Mr. du Toit in the Chair.

The Chairman (Hon. J. D. Logan), examined.

The Chairman resumed the Chair.

Resolved : That a Sub-Committee consisting of Messrs. Wilmot, du Toit, and the Chairman draw up a draft report for the consideration of the Committee and that it be an instruction to them to bring up the same on Tuesday, the 28th instant.

The Committee adjourned until Tuesday, the 28th instant.

Thursday, 30th July, 1903.

PRESENT :

MR. LOGAN (in the Chair).

Mr. de Smidt.	Mr. Ross.
Mr. Maasdorp.	Mr. Wilmot.
Mr. van den Heever.	

Minutes of previous Meeting read and confirmed.

The Sub-Committee brought up Draft Report as instructed.

Committee in deliberation.

Resolved : That the report be adopted and the Chairman instructed to report accordingly.

MINUTES OF EVIDENCE.

SELECT COMMITTEE ON DEEP WELL AND DIAMOND BORING.

Thursday, 25th June, 1903.

PRESENT:

Mr. LOGAN, (Chairman).

Mr. Maasdorp.	Mr. Wilmot.
Mr. Ross.	Mr. Van den Heever.
Mr. De Smidt.	Mr. Du Toit.

The Honourable Arthur Douglass, Commissioner of Public Works, examined.

Hon. A. Douglass.
June 25, 1903.

1. *Chairman.*] As Commissioner of Public Works you are head of the Boring Department?—Yes.

2. I think you have said that the average cost up to 500 feet is practically £1 per foot?—No, I do not think I have said it. I am not aware I have ever said that. The average cost on the railways works out at £2 per foot.

3. I have the report here. Can you explain?—I will give you evidence now—the average boring in the Railway Department. The Committee must understand that there are two sets of boring conditions—one in the Public Works and the other in the Railway Department. The average cost per foot of railway boring is £2 on all the boring we do.

4. But a farmer cannot go to the Railway Department for a bore. We don't want Railway evidence; that is boring departmentally. We

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want the cost for Public Works boring, in which case the farmer has the right to apply for his drill. Can you tell us their average?—There is a scale of charges which we base on the £ for £ principle.

5. But what would be the average cost of boring for the farmer, say, down to a depth of 500 feet?—You must get hold of the borers to work that out. I am not prepared to answer that as far as the Public Works Department is concerned, but the railways. The average cost of boring on the railways is £2 per foot.

6. *Mr. de Smidt.*] That is the actual cost?—Yes. The actual cost up to date. I must tell the Committee the average depth we bore on the railways is much greater than the average depth that we bore for the farmer, and the size of the hole we bore on the railways is on the average much greater than the size of the hole we bore for the farmer. It is a very difficult thing to work out, it is always altering from time to time; that is why I cannot give you the answer—the cost of boring to the farmer. At present the scale of charges is based upon the £ for £ principle; the farmer has to pay half and the Government has to pay half. The scale of charges for the Sullivan drill is £4 per diem for working day and night, and £2 15s. per diem when working by day only. For the ordinary steam drill it is 25s. per diem for each working day. The Sullivan drill is the only drill working by day and night. We do this because there is such a large amount of capital invested in this drill; that is, it is much cheaper; although you pay more for your labour, it is much cheaper to keep it constantly going. With the hand or horse power drills the charge is 12s. 6d. per diem; the jumper drill 12s. 6d. per diem. The charge for the steam power percussion drill (commonly called the steam drill) is 20s. per diem. In addition to these charges, the farmer supplies labour, fuel and transport. Those charges are based on the farmer paying £ for £.

7. *Chairman.*] Now, Mr. Douglass, you tell us the farmers have to pay £ for £. I have here the Hansard for the Council last year. If what you tell us is correct, have you not been misleading us in one respect?—I say I was not mistaken last year and I am not mistaken now.

8. But according to Hansard 1902 (pages 201, 202) you said that the farmer paid one-third of the cost. I should like you to make your two statements tally?—From the simple fact that we have put up the charge to the public. That is the way it is to be accounted for.

9. Then I understand this was actually in vogue last year?—It was more or less in vogue.

10. Were the Government last year, at the time you made the statement quoted, entirely paying two-thirds of the cost of boring for water for farmers?—They were not paying two-thirds.

11. Then this was a wrong statement?—It was not a wrong statement. I said in the House that it worked out on the average that the farmer paid one-third. I have seen the Chairman make this mistake over and over again. I have seen an answering affidavit of the Chairman in which he quoted the Commissioner as having stated that the farmer paid one-third and the Government two-thirds. That was not the statement; the statement was that so far as we could get it, it worked out on the average that the farmer was paying one-third. If the Chairman will only draw a distinction. There is a great difference. For instance, one farmer may have been paying nearly the whole. The farmer pays according to the scale. If as often happens at the first start off there was some difficulty, alluvial soil, great difficulties in fixing, etc., there would naturally be great waste of time. Then when the bore goes down, it is just possible it sticks. Sometimes the crown gets lost, if you have a bad foreman, for instance. I think the Chairman can tell you how a crown gets lost at the bottom of holes. A valuable crown would mean a loss of two

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[illegible]
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or three hundred pounds. You get such delays, because, as the Chairman knows from his private experience, a diamond will sometimes drop out and fall into the bottom of the hole. You have to get this diamond out, otherwise it will cut the crown to pieces. The consequence is that it is impossible to tell exactly what the farmer will have to pay. If the drill gets delayed from any of these causes, the farmer paying so much a day, he will pay an enormous amount for that borehole. That is why I cannot tell you exactly. That will explain the difference between what the Chairman has just quoted, what I said last year, and what I tell you now when I say that the farmer pays one-half.

12. You say, as a matter of fact, you were paying two-thirds when you made this statement last year?—I said that it worked out, as far as I knew, at about the Government paying two-thirds. You must always get in "about." When I tell you "practically," and you say I said the farmer was paying one-third, there is a great difference.

13. I must refer you to the Cape Hansard. If you had been misreported, you had ample time for rectification?—Excuse me, it would be impossible for me to go through everything in the Cape Hansard.

14. This is a very important matter. We have a statement here that the Government pays two-thirds of the cost (a statement according to Hansard), and the Commissioner says now that they are only prepared to pay half?—I think you rather twist what I say. I have never said that the farmers were paying one-third and the Government two-thirds.

15. Then Hansard is wrong?—What was right was that "practically" it worked out. You must note the distinction between saying that the thing „practically" worked out the farmer paying one-third, and trying to make out that it was a bargain.

16. The question is: what is the position of the farmer at the present time?—At the present time, on the scale he is now paying, I am advised they

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believe that it will work out to the farmer by paying one half.

17. We want to know exactly where the farmer comes in. For instance, you tell us that according to the scale, the farmer has to provide labour, fuel, and transport. Now don't you think it would be very much better if the Government were to frame a charge of so much per foot, and have to provide their own labour and provide their own fuel. A farmer wants a hole bored. He comes to the Government and says: "I want a hole bored for water" Do you not think it would be preferable if the Government charged so much per foot, so that the farmer would know his liability?— That is very difficult; the cost of boring varies so much. You start boring in one place, the work will finish in a few days. You come to another place, where you start in alluvial soil. You have great difficulties before you start boring. Then, the slightest hitch means delay. The bore jams, or a diamond has dropped out. Weeks may pass before that is rectified, and it may take months, whilst under the most favourable circumstances it might almost be done in days. Again, you come down to gravel strata, and you have to put down lining tubes, and immediately the whole cost of the thing is doubled. So there are great difficulties indeed in attempting to make any basis of so much per foot. We are endeavouring to do that by getting contractors to come and tender to bore at so much per foot, and there we find difficulties. We have to modify it all round—so much per foot in certain localities: so much per foot under other circumstances, so much per foot if lining tubes are to be used, etc. There is a very great difference.

18. But would you not be prepared to recommend some charge? According to your very best report —"practically"—could you not come within the range of possibility, and make a certain charge? Could you not make some definite charge of so much per foot? Could you not come to the practical part, and there we would be able to get to

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something definite? Otherwise there is no finality? —Would it be fair that one farmer who wants a hole bored in very hard rock should only pay the same as the man who wants a bore put down in soft sandstone. When we go on a farm I think we know fairly well what to expect. If you bore on the Karroo, on the shales, for instance, or in sandstone or in quartzite—you know in each case.

19. Would it not be advisable to have a direct charge made to the farmer?—At so much per foot?

20. Yes.—I do not think it is as good as the present method. This method gives the farmer an interest in doing all he can to get the boring done as quickly as possible.

21. Then you don't think it advisable that a charge should be made so that a farmer would know what he wants to know, viz., where his liability commenced and ceased?—I say no. I think the present system is the best. The farmer then has an interest in getting the work done as quickly as possible, because the charge is so much per diem when the drill is working on his place. The consequence is that he will assist the Department in seeing that the foreman gets the work done as quickly as possible. He sees that his men put in a good day's work. In every way it is to the farmer's direct interest to get the work done as quickly as possible. On the other hand, if he were charged so much per foot he would have no interest as to whether it took six months or six weeks to get the hole done.

22. You have just told us it would be in the interest of the farmer. Is the farmer in charge?—I said it was in the interest of the farmer to see that those men that he had to supply put in a good day's work.

23. When these men are there, is the foreman under his charge?—The foreman is not under the farmer's charge.

24. Under whose charge are the men employed? Under the farmer's?—They still belong to the farmer.

25. Has the farmer the right to give them instructions?—The farmer has the right to see that these men are there to time; that they begin in the morning and put in a good day's work.

26. Under whose charge are these men?—As far as the boring is concerned, under the direction of the foreman.

27. The foreman has nothing to do with the farmer?—No, nothing.

28. Then, as far as the farmer is concerned, he pays for all and has nothing to say?—He has a great deal to say. He can report to the inspector if a full day's work is not being got out of the men.

29. Would it not be in the ordinary course of things in the interest of the country if a charge were made?—I think that if it is in the farmer's interest to see that all this work is done both by the foreman and the men themselves, they are much more likely to do it smartly then merely in the general interest of the country.

30. Have there not been occasions when the parties have come to loggerheads?—Nothing has come directly to me.

31. You don't know of any case?—Nothing has come to me to adjudicate upon.

32. Can you give us particulars about the average cost?—It varies very much. You had better get the inspector of drills.

33. You have been an employer of labour pretty considerably. Do you not think when you get a staff of men put on a certain work that if they are continually at their work they are of very much more use than if from time to time turned on to other work? By that, I mean supposing we were to go and make a certain charge to the farmer? The Government would have their own labour, men used to this class of work. Would these men not be of much greater service than those engaged just in a haphazard way by any particular farmer, and who might, for instance, drop a drill down at at any moment?—The Government would certain-

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ly pay a great deal more for that rough labour than the farmer would. Consequently we should have to charge a much higher price per foot than we do at the present time.

34. I would not call it rough labour. I was under the impression that by having your men continually with one drill, having continually four or five boys accustomed to the work, would it not be more in the interest of the Government to have this done by experienced labourers and let the Government find their own labour and go round with the drill in preference to going and picking up a lot of hobbledehoys?—Very often the Government cannot get labour.

35. Would it not be in the interests of the Government to have their own boys?—I think it would be very much more expensive for the Government to supply rough labour than for the farmer, and the consequence is that the farmer would have to pay more in the long run for getting the work done. It would be very difficult for the Government to get men without paying a price that will compete severely with the farmer. The boring foreman would come round and tempt labour from the farmers; he would have to keep filling up his staff. Two men would leave him for instance; he would have to take on two men from the farmers around on his staff. Complaints would come in that my foremen were bribing labourers away from the farmers. The Government would offer a much higher price than the farmers.

36. *Mr. Du Toit.*] Do I understand that the Government are asking for contractors to do the work?—Yes, we are trying to overcome the glut of applications that are coming in. We are trying to get those persons that have private drills to tender to us, by giving them a whole district, and so give them a large number of boreholes, so as to be able to give the farmer another way of getting the work done instead of waiting their turn, as they have to now.

37. Is there any possibility of coming to terms with these contractors? I mean, if when they go about to bore, they are only paid when successful?—That is a matter which I have thought over, but is it fair to the general public. The farmer simply having the drill put down, and then no water being found there, would it be fair that the general taxpayer should pay for it, and the farmer have no loss. If that were so, the number of applications would multiply a hundredfold; every farmer would then put in applications for bores.

38. The man going about with the bore, has he to point out the spot to bore, or must the farmer point out the place?—We listen to the farmer, and if possible we meet him by boring where he wishes. Our drill foreman would have power to refuse to bore at any spot if he thought it impracticable. We have placed a geologist on the estimates this year, and one of the services of that geologist will be to give us scientific advice as to the best sites for boring.

39. Supposing a foreman comes to a farmer's place, and the latter points out a certain place, saying, "I want water here," then it is for that man to say, "It is no use, there is no water." He ought to have some knowledge?—The man uses the knowledge as far as he has got it, and advises the farmer. There are, however, difficulties which the farmer may not have foreseen, as to whether water for working is available, for instance. Boring needs a considerable amount of water. The farmer may not know the difficulties of working, and makes up his mind perhaps that the boring must be put down where it cannot be kept supplied with water. There has been, as far as I know, no friction between the farmers and the foremen of the bores. We have inspectors of bores going about, and I suppose an inspector would come in and smooth over any difficulty. No complaint has come before me.

40. How far are you in arrears with regard to the number of applications made for drills?—You will have to send for the inspector of drills.

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41. You do not know?—I am not prepared to answer you now. I have not the statistics.

42. Might I ask: Are you prepared to get statistics, and arrange in the event of being so very far in arrears, new drills are got out and placed on the supplementary estimates for the purpose of meeting the demand?—We have new drills on order.

43. *Mr. Wilmot.*] Diamond drills?--Not necessarily. We have one screw feeding drill, estimated cost £1,200; two steam power percussion drills, estimated cost £400 each. These are the orders.

44. Considering that last year you had 997 applications waiting to be attended to, and only 47 drills available, and I suppose the average time taken would be about three months for each hole, I suppose they would be as old as Methusaleh before they would be attended to. Do you not think it necessary for some more money to be placed on the estimates for the purpose of meeting this demand?—The question is, how far is Parliament prepared to go in the way of boring? Boring was originally started to test where there are underground supplies. It was not originally started with the idea that we were going to bore for every farmer to give him water. This, however, has been growing up of late since boring has turned out so successful, and now a very large proportion of farmers want drills put down. I do not know how far Parliament is prepared to go. We have at the present time a total capital employed of £26,654. That is for the farmers' drills, not the railway drills.

45. The question is: do you not think it would be advisable to put a sum, a very fair sum, on the supplementary estimates, considering the success that has attended water boring, in order to increase the number of drills?—In the past it has not only been the matter of providing drills, but the difficult thing has been to provide foremen. I think, you, Mr. Chairman, know from experience the difficulty of getting trained foremen. I put a very great increase on the salaries of foremen during

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last year; I simply had to go further and increase the price, in order to get foremen. If we were suddenly to buy a large number of drills, we should be in the same difficulty that you were in, Mr. Chairman, when, even in searching through England, you had great difficulty in getting a foreman.

46. If this idea were carried out with regard to paying for your own staff, such as foremen and getting assistant foremen, if you relieved the farmer of any liability in connection with labour, and got a number of young Colonists to go in for it as assistants, and got them to go with a reliable foreman, you would then be creating foremen? Do you not think it would be possible to get these men?—We have always assistants to go round, training. I don't think we should ever refuse any promising assistant. He is paid a small sum. The difficulty we have is this: as soon as you train a man, there are outsiders who want to get him away. You find yourself a training-school for the benefit of outsiders.

47. *Mr. Maasdorp.*] With reference to boring, have you been more successful on railway works than on private property?—No, I do not think so. We have been more successful on private property. With regard to the railway, we have a more limited choice of sites. Where we want water, we have to try and get it at any cost.

48. Have you struck any artesian water in that way?—Yes, I think we have at some places, but nothing very striking. I think at the Chairman's place at Matjesfontein boring has been more successful.

49. *Mr. de Smidt.*] Is railway boring carried on under the supervision of an expert?—Yes, we have two experts, one in the east and one in the west.

50. *Mr. Maasdorp.*] I do not understand the matter of cost. You say the contribution is on the £ for £ principle for boring on private property?—That is about what it works out at. The man pays by a certain scale. We say that on the average we think it works out on the £ for £.

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51. Is there no possibility of calculating the cost accurately? You say the farmer supplies labour? Does he pay for that labour entirely himself?—Yes.

52. Does not the Government share that expense?—No. Over and above the charge he pays, he also undertakes to supply labour, transport and water.

53. *Chairman.*] Is it a fact that the rules and regulations that I hold here (November 19th, 1902) are right or wrong, wherein it is stated that the charges to be paid in respect of Sullivan drills, £4 per day, will be made if working day and night, and that £2 15s. will be charged for day working, that is when working by day only?—That is perfectly right as far as the Sullivan drill is concerned. There are only three Sullivan drills out of the whole lot. The Sullivan drill is a very big drill, estimated to go down to any level not exceeding four thousand feet. The charge for an ordinary steam drill which bulks very largely in the number employed is 20s. per diem. For the smaller drills (hand or horse-power drills) it is 12s. 6d. per diem.

54. *Mr. Wilmot.*] In the conflict of opinion between the Government fixing an amount per foot or retaining the present system, would it not meet all objections and satisfy farmers, Government, and the taxpayer, if all drilling were performed by the Government under the most economical conditions consistent with efficiency, and the farmer in all cases only paying half the nett cost?—I am not aware of any conflict of opinion between the Government and the farmers. The great number of applications that are lying waiting to be served together with the great number that are coming in every month, shows, I think, that there is no conflict of opinion. I think that the farmers are extremely well satisfied with the conditions on which boring is carried out. I think the farmer finding labour and paying so much a day for the drill is the most economical way both for the farmer and the Government. If the Government had to keep up the supply of labourers instead of the farmers getting them, the boring would be

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done at very much greater cost, and there would be very great outcries about the Government enticing farmers' labourers away by giving a much higher rate of pay than what the farmer is paying the men on his own farm. As a practical farmer myself, and having been farming all my life, I know what a great danger it would be to me having a Government foreman coming on my farm with six or eight coloured men who would be receiving 4s. to 4s. 6d. per diem wages, where my own men would be receiving a very much less money value wage. My labourer would perhaps really be getting as good a wage if he could follow it out, with better conditions of life, and facilities for keeping a little stock, etc., but this is the point: he would simply know from the Government men that they were getting 4s. 6d .a day, and the chances are that when the drill left the farm, I should find my labourers leaving me.

55. *Mr. Wilmot.*] I want to leave you with full power; you could do as you please. Would it not be well to debit that half net to the farmer?—No, I have explained that I do not think it would. I am not aware that there has been any conflict. Look at the great number of applications.

56. Would it not be common sense supposing there is no conflict?—Then you would have endless disputes as to what was the net cost.

57. You could make an agreement and obviate disputes?—I think the present system best; I think it is working smoothly and well.

58. Do you not think it very hard that the farmer would be charged for the hire of the drill, when waiting, say, a fortnight, for a crown?—The farmer is not charged when the drill is hung up by any default of the Government.

59. *Mr. Van den Heever.*] With regard to the farmer, is it the intention of the Government that the bores, the proceeds, should make up for all expenses connected with the boring?—We had to bring up the cost of boring, because we could not get foremen, and because diamonds were double or

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treble in price, and in fact because the whole cost of boring had very greatly increased. We therefore had to bring up the scale.

60. Have you had instances brought to your knowledge of bores being broken or damaged through the clumsiness or inefficiency of those handling them? Is this not likely to happen?—I would say from my own experience as a farmer that when I got a Government drill I trained three Kaffirs to work it, and that after six months I left those Kaffirs entirely to work it. I went on boring for two years.

61. Going about from one place to another, you have always to be getting new men? Is that not objectionable.?—There is a great deal in what you say. I have been pointing out other drawbacks. The farmer only finds raw labour; we find the engineer and the assistant.

62. But sometimes the farmer cannot find labour, and then the boring stands still?—I have pointed out the drawbacks in the other way. You would have Government men, highly paid men, going on to a farm, and making the whole lot there dissatisfied.

63. Suppose there is any hitch with the bore, suppose it breaks, and there is some delay? In that case how do you reckon the time. Do you allow for delay in all cases?—That is a technical question which you had better ask the inspector of bores.

64. Taking everything into consideration, is it not too much expense for the farmer? Does it not come too hardly upon him?—No, it is not too much for the farmer, because there are a vast number of farmers applying, more than we can accommodate.

65. You say you cannot get labour. Hundreds of others are in the same position; they cannot get labourers or even herds for their flocks. That raises an important question: what do you suggest?—The farmer can get the drill inspector to engage labour, if he cannot do so himself, and, of course, the farmer pays for it.

66. But you have such great difficulty in getting it. Here at the Cape, people are complaining. I myself am placed in the same position. Farmers must have great difficulty in getting labour for the drills?—If the Government had to pay these labourers and take them round they would cost very much more than at present. We should have to pay them, even if anything went wrong with the drill. If we sent a drill with two white men and six or eight coloured men and anything went wrong with the drill (through a crown sticking or anything like that), for, say, a fortnight, we should go on paying these six or eight men, if they were Government men, for doing nothing; whereas, with the farmer, they could go on doing other work until the drill was ready to go on again. You know what it means having six or eight hulking natives on your farm, lying idle. The farmer has no control, and the devil finds work for the idle.

67. Don't you think, in your proposal, that the farmer has really a greater share of the cost than the Government?—I say no. I think that the Government pays a great deal more than the £ per £. My officers can give you returns, if the farmer is paying £ for £, but I do not think he is paying that myself.

68. *Mr. Du Toit.*] I understand from the Commissioner that the farmer has to give all raw labour, and to provide boys, food, transport, and fuel. Then the farmer has to pay £2 per diem?—Which drill are you talking about? There are only three Sullivan drills for deep boring. For ordinary boring, you use the ordinary steam or hand or horse-power drills. With the ordinary steam power it is only £1 per day. It confuses things if we talk about the Sullivan drill.

69. I understand you to say that the farmer has to pay half of the expense. Does the Government share in paying for the labour that the farmer has to provide? Does the Government share in these

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expenses connected with the labour and boring?—The farmer pays his 20s. a day. That has got to cover the cost of the diamonds used.

70. So that the farmer is paying a half exclusive of the labour, etc., which he has to provide?—Twenty shillings a day and the labour he throws in is estimated to be half the total cost.

71. *Mr. Wilmot.*] And you don't think it actually comes to that?—No, I don't think it comes to that. We cannot get contracts to bore, which shows there is no money in it. If there was money in it, we should have plenty of applications for contracts.

72. *Mr. De Smidt.*] Have farmers ever complained to the Government that the boring on their farms was not carried out economically?—Nothing has come before me; they would write to me direct if such was the case.

73. *Mr. Van den Heever.*] With regard to the selection of a site, the farmer does not necessarily know where the water is. Is it not better for the Government to get people that can tell where the water is, and not to rely upon the farmer?—Nobody can see underground. It is very often that the local knowledge of the man is better than the expert knowledge of the geologist.

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74. *Chairman.*] You are Inspector of Boring in the Cape Colony?—Yes.

75. Under which Ministerial department?—Under the Commissioner of Public Works.

76. Can you tell us the average price, say for 500 feet with regard to Public Works boring, as far as your own knowledge goes?—About £1 a foot.

77. How many drills have you got?—We have 47 drills at work now.

78. Can you tell us how many bore holes have been put down?—Since I have been in charge, that is five years, we have put down 2,000 bore holes.

79. In how many cases have you been successful in finding water?—About 75 per cent. One-third of the water tapped flows at the surface.

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80. How many applications have you got at the present time for the use of these various drills?—There is an accumulation of rather over a thousand.

81. From your experience, how long do you think it would take to catch up the arrears (going as you are at the present time)?—Every day we are receiving as many applications as we can work off with the 47 drills. With the present plant there is no chance of ever having less than a thousand applications constantly outstanding.

82. You say that to a depth of 500 feet you think an average of £1 per foot a fair price?—Yes. The diameter of the bore hole, however, is a matter to be considered.

83. Are you of opinion that the present system of working our drills could be improved upon, in the way of making a direct charge? To find out the average cost, and then charge the person who wants the drill with a direct amount—so much per foot, going on the average?—In that case the charge would have to be regulated by the diameter of the bore hole. You would have to have a scale of charges per foot. But the trouble would be in this direction, that if you arranged for the price to be £1 per foot, a farmer who had a bore hole in soft ground that only cost, say five shillings, would not like the arrangement at all. He would object to it strongly. If you charge an average price, you must make hard rock pay for soft rock. Under the present system of a daily charge, it takes a longer time to bore in hard rock than in soft, consequently the charge in that way is more or less proportionate to the difficulties of the work.

84. As a practical man, don't you think, the farmers now having to employ labour, you would be able to drill much more effectively, and with greater security with regard to the loss of crowns, for instance, if you had your own working boys?—Oh yes, I think so certainly. I think if we had our own transport and our own boys, we could do the work more economically; there is no doubt

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about that. That could be easily arranged by making the charge per day higher, to make it include transport and the cost of labour.

85. Do you think (if the farmers were agreeable to strike an average, and supposing that, practically the Government paid two-thirds of the cost), that a regular charge could not be laid down, taking the good with the bad? Let the man who is lucky and has soft ground pay a little more. Would it not be better to make a direct charge and leave the whole thing in your own hands? We have already adopted that principle in a measure by letting out contracts for boring. We have let out contracts in the Middelburg district at 17s. 6d. a foot not lined and £1 if lined, of which the applicant pays half, if he chooses to take up that kind of boring, and the Government pays half. Of course we have asked applicants in the Middelburg district whether, instead of waiting their turn to have the Government drills, they would like to adopt the contract system; and have told them if they agreed they would have to pay 8s. 9d. per foot not lined, and 10s. 0d. per foot for a lined hole. These holes are six inches in diameter.

86. You think it is an improvement; you would not have adopted it otherwise?—That was adapted with the idea of working off some of the accumulation of the thousand applications, viz.: to let some of them by contract. I suggested this plan. It would work excellently well but that there are so few contractors who undertake boring work here. If this industry were more developed, we could easily get the whole done in a couple of years.

87. Do you think we have enough drills to meet the requirements of the country at the present time?—No, certainly not.

88. There certainly ought to be more drills?—Yes, most certainly, if it is desired to work off the thousand applications.

89. *Mr. Maasdopp.*] I understand you to say that you could work the thing more economically if you had it in your own hands, as regards labour

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and so forth, that is, if you had a staff of boys travelling about the country?—Yes. At present our boring machines are sent out with a foreman and an engine-driver, but if we employed our own boys we could send three boys as well and a wagon and oxen to convey the whole thing. That would avoid delays and we would always have boys already accustomed to the work.

90. You think that that way is a more economcal system?—Yes, I should think so. It would not make much difference to the Government's arrangements.

91. If you undertook to supply boys you would have to pay more than under the present system, getting farm labour?—I do not know.

92. *Mr. Wilmot.*] What do you pay the boys?—The farmer supplies the boys; we never pay the boys. Every farmer supplies labour, fuel, and transport; that is his part of the contribution.

93. *Mr. Maasdorp.*] I think it is admitted that the Government pays more for labour than the farmer?—The Government do not employ any farm labour.

94. As a general thing the Government would pay from 4s. to 4s. 6d. a day. It does not cost the farmer anything near that?—The farmer does not pay direct wages; he pays in kind, it comes to much the same thing. I do not think the Government pays higher wages than the market rate.

95. There has been a difficulty raised with reference to that. Can you be sure of having your labour always? In case of your going about like this, in case you lose any of your labour, would you then have to draw upon the labour in the different farms, giving rise to considerable dissatisfaction by taking away the boys from the farmer himself?—The amount of labour required is very small. It would make no appreciable difference. We only require three boys to each drill. We could do the same as the contractors.

96. Have you any contractors actually at work? Yes. We have one in Middleburg district; he has already finished seven bore-holes.

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97. Are the farmers satisfied?—Yes, at having adopted that system. We have practically forty who have applied to be served in that way. We are also doing the same thing in the Cradock division, where we have a large number of applicants, about 200, and in Middelburg division about 100. We have adopted the contract system in these two divisions because that is where a large proportion of the work lies.

98. How do you work now as regards the applicants? Do you take them in rotation, in the order of application?—Their applications are registered with the name, farm, ward and district. Then when a drill is sent into a division it takes one ward of a division, and begins on the farm nearest to the point at which it enters that division. Then it takes the others in order of priority in that ward, also taking into consideration geographical position, that is, if the first and the third men on the list are on one particular side of the ward, and the second on the other side, we take the third before the second. We leave the details to the common sense of the farmers; we find no difficulty, they generally arrange it among themselves. Perhaps one man finds it more convenient to take the drill than the man whose turn comes next. The latter says: "No, I would rather my neighbour take it first, because I have no boys or transports." Then an arrangement is made accordingly, there is no difficulty about that whatever.

99. You accommodate yourself really to the accessibility of the different places, to save as much time as possible, and also to the wishes of the farmers?—Most certainly.

100. *Mr. De. Smidt.*] Have the farmers ever complained to the Government that boring work on farms was not carried out economically?—We have occasional complaints, but the percentage is very small. Of course, we have to deal with some difficulties in this, as in carrying out any other public works. Some of the foremen are not so good as I should wish, and do not do their work properly.

There are also delays very often occurring through not being able to supply diamond drills with a newly set crown. But the best is done under the circumstances, and any complaints received are attended to at once. My usual practice if I receive a complaint is to send an inspector at once to investigate. I have an assistant and also an inspector of foremen quartered at Cradock. If anyone in the Middelburg district, for instance, wrote and complained, I should wire to my assistant at Cradock to send the inspector or go himself at once to the farm to see what was the matter. If the foreman is to blame, he is reprimanded. Causes of delay lately have been due to the fact that we have not been able to reset the crowns here in Cape Town rapidly enough. That is entirely due to our being unable to engage more diamond setters. There are none; all those in the country have gone to the Rand and will not come down here for love or money, so consequently I am obliged to do the best I can with the two diamond setters I have. If more crowns are required than these two men can set, the drills have to wait.

101. *Mr. De Smidt.*] Have the experts whom you employ any geological knowledge of the country in which they are working?—I have adopted a system of teaching my foremen geology. I supply them with elementary books on geology, and the reports of the Geological Commission that relate to their districts, as well as boxes of rock specimens so that they can recognise the rocks they meet with in boring. Whenever I go on a tour of inspection I make a point of giving geological information to the men. Some of these men are very expert, especially after boring any length of time in a district. When I first took charge of this work I thought of having a specially qualified man going around the country and pick out all the sites, but I found that to be impossible; he could not do it alone. With forty or fifty drills working, every day or so a new site is required.

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One might be wanted here in Cape Towu and another at Norval's Pont. I should want about five experts in order to do that properly. The salaries would amount to too large a sum of money.

102. What happens when the opinion of the expert is in conflict with the opinion of the farmer who wants boring done in regard to this or that site?—In the regulations the applicant has the option of pointing out or selecting the site. If he does not wish to select a site the foreman of the drill selects one.

103. *Mr. Wilmot.*] What do you think of this plan? Let the Government do its best to unite efficiency with economy. In cases where it is desirable to take labourers, doing so; in others trusting to the farmer; always working the best way possible under the special circumstances of each district. In all cases making a contract with the farmer that he will pay half net cost, as certified correct by the Commissioner?—The farmer very often works himself. As you know, a great many farmers are poor; they come and work there instead of the labourer.

104. Give him wages as a labourer and debit the cost of it; that is quite simple?—Yes, but I doubt whether it would be an improvement on our present method.

105. *Mr. van den Heever.*] How many are employed directly by the Government in connection with the bores?—An ordinary steam drill has a foreman and an engine man.

106. What is the cost per day of the foreman and engine man (driver)? We pay our foreman from £15 to £25 per month, an average of £20. The engine men get about 5s. 0d. per day.

107. What is the cost of working the Sullivan drill?—With the Sullivan drill you have a foreman, an assistant foreman, and generally two engine drivers, and sometimes a diamond setter. We will take the drill as working for the Chairman as a specimen. About £3 17s. in wages per day, that is on the side of the Government.

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108. And the second drill?—Counting 25 working days to the month, we will say about 22s. 0d. per day on the side of the Government. I gather that you wish to know the basis on which the charges for the hire of the Government drills are made, and is going to ask what every item of expenditure amounts to whether paid by the Government or the applicant for each class of drill. In this case it would be better to hand in the detailed statement of the cost of working the drills from which these charges were evolved.

109. *Mr. du Toit.*] What is the procedure with regard to the applications? How many are required from each district before you send a bore into that district?—The method adopted now is when boring is finished in any district, to send the drill to the next district that has the greatest number of applicants.

110. There is no fixed number of applicants required before you send it?—Well, we should not send a drill into a district unless we had five applicants. If we had sufficient drills we should put a drill in a division with less than five applicants, as more would then apply. There is no fixed number.

111. To what depth can the boring go per day?—That will depend on the rock—whether soft, hard or medium. From one foot to ten feet. In extremely hard rock we could not do more than a foot a day.

112. And if the ground is soft?—Then ten feet or even more. If very soft, the hole would not stand alone; it would have to be lined. That would compensate for the quicker boring.

Thursday, 30th June, 1903.

PRESENT:

Mr. LOGAN (Chairman).

Mr. Ross.	Mr. Wilmot.
Mr. De Smidt.	Mr. van den Heever.
Mr. Maasderp.	Mr. du Toit.

Bernard William Ritso, M.I.C.E., F.G.S., further examined.

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113. *Mr. van den Heever.*] If you bore through soft ground is the charge the same as when boring through rocks ?—Oh, yes. As the charges are by day, it makes no difference. If the ground is soft then, of course, very much more is done in the day.

114. Do you think it necessary to get an expert or an hydraulic engineer, I mean someone who would know where you would be able to bore with more chance of success than you would be otherwise doing ?—Yes, when I first took charge of this work I thought it would be better to have an expert go round and point out the sites for boring all over the country. I found, however, that that would not be feasible with 47 drills. For instance, you might want a sight selected at Cape Town, another at Norval's Pont, and perhaps another in the Transkei on the same day. You would then have to employ five or six experts. These men would have to know something of geology and hydraulics—men paid, we will say, £400 to £500 per year. It would be too expensive altogether. The plan I have adopted is to teach the foremen some geology, and give them other information so that with experience they can select their own sites.

115. But one man might go to a dozen places in one district and in a very short time point out all the different spots ?—With 47 drills at work you would want about five men. It would not be possible to select sites beforehand. The data obtained by sinking one would be employed in selecting a second borehole.

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116. But in one day an expert could point out ten places at least?—If the sites were required in the same neighbourhood. You do not know where you require a site until the drill comes on the farm. You think that all the sites for boring should be selected by an expert and geologist.

117. Not all the borings but more or less. Could this not be done?—That is really the proper way of doing it but it is not down owing to the expense.

118. Why should so much time be wasted in boring in unlikely places as is the case now? There are a large number of places where boring is not attended by satisfactory results. Is that not due to the fact that expert opinion has not been taken?—Precisely so. In the first place the regulations allow the applicant to select sites, and of course many applicants have no knowledge whatever. The foreman should have sufficient geological knowledge to pick out sites in the easier formations. Some of the older men are very expert at it, but the younger men are not; they have not the experience. It would, of course, be infinitely better if we could have a geologist to pick out all sites in the more difficult formations.

119. Do you think it is absolutely necessary to engage a man in order to save time?—I believe that a geologist has been put on the Estimates this year.

120. But is it not necessary?—I think so. I decidedly think so. It was at my request that the money has been put on the Estimates with that object, the object of securing the services of a geologist.

121. Have you had any experience of these men who go about the country showing where water lies with divining rods?—Oh, yes, a great deal of experience. A great many holes are put down on the sites selected by these men. I should say that the greatest number of them are unsuccessful. For instance, only the other day we bored on a site

selected by one of these men near Phokwani, in Bechuanaland. It was located on a dyke of purely igneous rock of unknown depth.

122. I should like you to give full particulars of the cost of boring ?—I have this statement to hand in ; it is the estimate upon which the charges for the hire of Government drills are based, and gives full particulars. (Annexure B.)

123. *Mr. De Smidt.*] Can you inform the Committee whether boring is carried on in any of the other Colonies by Government aid ?—As far as my experience goes, in Europe there is nothing of the kind. I studied this question when last there in 1900 and devoted a large amount of time to the methods of sinking artesian wells and the machinery employed. I attended the International Congress of Boring Engineers at the Paris Exhibition and became acquainted with the leading authorities on the subject on the Continent; I reviewed the exhibits of Boring Machinery there and examined the large Percussion Drill working in the Exhibition grounds where it had put down a borehole of 1,900 feet, of 5 inch diameter, in 90 days (which I may mention subsequently tapped the Paris basin at 2,000 feet and flowed at the surface with a large supply). I visited many boring operations in England and saw boreholes being put down for water supply for towns, public baths, mineral water manufactories and for agricultural purposes. The only diamond drill that I saw at work was boring for coal near Birmingham. I did not hear of State aid granted for boring for water although large sums were being devoted to the search for minerals with the diamond drill by the German Government. The climatic condition of Europe do not give such prominence to its value for agricultural purposes as those of a semi-arid country like this. Great numbers of boreholes have been sunk in the United States and Canada for every conceivable purpose and a large industry in drilling wells has been established, but as far as I know no direct state aid has been offered to the

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agricultural industry for this purpose. Indirectly, however, the Government of the United States have given the most valuable assistance by making the geological survey of the country and locating on it all the area of permeable rocks and investigating their water bearing horizons, so that anyone desiring to obtain a supply of underground water can first inform himself if it is feasible to bore at all, and then at what depth he is likely to to strike water, from which he can calculate the probable cost. The application of geology to the search for underground water has appealed strongly to the practical American mind, and the Government has spent large sums in this way, with the result that anyone who wants to bore sends for a boring contractor, gets a 6 inch well put down to water his flock or irrigate his lands with very little risk or failure. This no doubt has been an appreciable factor in the phenomenal productive power of the agricultural industry of the United States, which has assisted in no small degree in the triumphant progress and great prosperity of the country. Our farmers have not had the intimate connection between the geological survey in progress here and their bread and cheese explained to them, or doubtless they would be anxious for it to get on faster, so that this generation may benefit by it.

124. But in the Colonies ?—In Canada I do not think there is anything. Australia, semi-arid like South Africa, is pre-eminently the country which must utilize its subterranean waters for pastoral and agricultural purposes, and this has been done of late when, after delays of many years, the various Governments came to the rescue of the stock farmers and agriculturists, who had been experimenting for a long period, and put down deep trial boreholes under competent engineering and geological superintendence and advice, with the result, among others, of discovering the extent of the vast underground reservoir of Queensland, which is said to be yielding 360 million gallons of

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water a day. The Australian underground supply is probably much larger than that of South Africa owing to this wonderful Queensland artesian basin, but other States of the Commonwealth are not so favoured. Victoria has spent large sums of money in exploring the country in search of underground water, but without success. Western and Southern Australia have tapped either poor supplies or supplies so impregnated by minerals as to be unsuitable for stock or irrigation. The more evenly distributed supply of *good* underground water available in this Colony may be found to be quite as valuable in developing the agricultural resources of the country as that of Australia. To explain, I may add that although there are in Australia some of the finest artesian supplies in the world, it is partial to one part of the country, whereas our supply here is spread practically all over the country. There is hardly anywhere where you cannot get a supply of water in this Colony. I have been informed that near these great Australian artesian supplies sheep have been seen dying; they had plenty of water, but nothing to eat. That is to say, water alone does not imply good pasture.

125. You cannot say whether the Colonies receive State aid?—I cannot positively say. I have never heard of it. I have never heard of any country where the farmers receive the same kind of State aid as here. The usual thing is for the Government to do experimental work.

126. *Chairman.*] Have you any data, showing the cost of the boreholes for a period of some years so that an idea can be formed of the average cost of the boreholes, including both the share of the cost paid by the applicant as well as that borne by the Government?—During the five years 1898-1903 it can be roughly stated that 2,000 boreholes, between 10 and 800 feet in depth, and varying from two to six inches in diameter, were put down at a total cost of £100,000, or an average of £50 each. Of these 1,600 were successful, and yielded a total

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supply of 16 million gallons of water per diem; and of this quantity 6 millions flowed at the surface, while the remaining 10 million gallons required windmill pumps to raise it, which would cost, on the basis of 1,000 windmill pumps at £50, another £50,000. Then 1,600 completely equipped boreholes yielding an average supply of 10,000 gallons each, cost £150,000, or an average of £93 15s. 0d.

127. Have you any basis on which you could obtain an approximate idea of the money value of this daily supply of 16 million gallons of water?—The charges of 12s. 6d. per quarter for a supply of 100 gallons per diem made by the Suburban Waterworks might be used as a basis, although it is apparent that the intrinsic value of water in the Karoo with a rainfall of only a few inches is far more than in the suburbs of Cape Town with a rainfall of 70 to 100 inches. Then, a daily supply of 16 million gallons would be worth 16,000,000 divided by 100 and multiplied by £2 10s. 0d., that is, £400,000 per annum, which yearly revenue capitalized at five per cent., twenty years' purchase, is £8,000,000, the present money value of the supply of water obtained at a cost of £150,000.

128. If this calculation is anything like correct, the farmers' and the taxpayers' capital is employed in a highly productive manner, and the Government must be congratulated on the initiation and development of the water boring scheme. Can you also give the Committee an idea of the extension this work is capable of?—This boring work could be prosecuted to an almost unlimited extent, as a careful study of the question, in the light of the five years' experience I have had in the Colony, would point to the supposition that a daily supply of over 200 thousand million gallons lies spread over the country in the accessible portion of the crust of the earth, where it can be tapped by boring, and would either flow at the surface or could be raised by windmill pumps As all the boreholes only draw on this supply for

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the insignificant supply of under 30,000.000 gallons daily, it is obvious that there need be no fear of exhausting the supplies even if there were no rainfall at all. It would appear that in quantity there is a sufficient supply of water stored in the rocks to cover the country with bore-holes, so that every farm could have its irrigated area as well as increase the stock-carrying capacity of its grazing lands. What has been done to exploit this great natural resource seems, in comparison with the immense possibilities for the development of this means of water supply, only a small beginning. A wealth of water beneath our feet waits to be utilized, which, if it could be put on the land, would increase production so as to revolutionize the agricultural industries and ensure the material prosperity of the country.

129. Could you make any suggestion for the prosecution of these operations during the next two or three years, such as would come within practical limits with regard to the financial means at the disposal of the Government?—I should, in view of the importance of the matter, think that provision should be made to put down 10.000 boreholes during the next two or three years. I believe that Parliament will be asked now to largely increase the vote for the ensuing year, and if in the following years it was proportionately increased, a work of that magnitude might be accomplished within that period. It should be borne in mind that a large percentage of the funds required, say, £500,000, would be refunded by applicants, and would only be capital loaned to the agricultural industries, and also that by a judicious arrangement of contributions the balance actually expended in State aid might be adjusted to bear lightly on the taxpayer.

130. Would these boreholes or artesian wells be of the same size as those already put down?—No; experience points to the desirability of increasing the size of the boreholes, so that larger pump cylinders can be used, and consequently larger

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supplies pumped or greater volumes flow at the surface. This can be done in the softer formations of the Colony at no great extra expense, but the boreholes in hard rock must remain the same size on account of the high cost of diamond drilling.

131. What size would you recommend?—I should suggest that all boreholes that are put in the softer formations should not be less than six inches. Of course in hard rock we cannot afford to make them as big as that—not more than three inches.

132. Do you think there is any probability of obtaining larger supplies of water flowing at the surface from greater depths than those already tapped?—Water flowing at the surface has been, up to the present time, found in the younger formations of the Karroo, but at shallow depths and of no great volume; the conditions necessary to exert the pressure being chiefly due to the dykes of igneous rock which intersect that region, and form, as it were, underground dams. I am, however, of opinion that by carefully selecting sites among the older rocks of the south and west of the Colony, which are much folded, and by boring to depths of 500 to 3,000 feet large supplies of true artesian water under pressure may be tapped. As lately some powerful machines capable of boring to such depths have been imported, and are working economically and efficiently, the Government is now in a position to put down a series of boreholes to test this theory; which experimental boring, if successful, would be an object lesson to the agricultural community, and encourage deeper boring by applicants in situations where favourable conditions exist.

133. With regard to the plant, that is the mechanical means of sinking these boreholes (the ordinary ones, not the very deep ones) what is being done to increase it?—With regard to the plant, experience in working the machines, coupled with the immense rise in the price of diamonds, and the scarcity of transport, has led to some unquestionable conclusions. These are (1) the hand-power

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diamond drill is not a suitable machine for boring for water in this country at the present time, and should be discarded; (2) that the steam power drill is a fairly economical machine for hard rock and shallow depths; (3) that the steam power percussion drill is the most economical and effective machine for the greater proportion of the work; consequently it is in contemplation to re-enforce the effective strength of the plant by adding a large number of these machines only. However, before ordering a large number, the precaution is being taken to ensure the purchase of the best type of machine; two of an American pattern are working in the field, and another is just landed, while a fourth of a different pattern has been ordered, and the contractors to the Government, here in Cape Town, have in hand a machine designed under my own direction which will possess original features peculiarly suitable to the country—so that, perhaps, the Colonial manufacturer may rival his American competitors. When these machines have all been tested, I shall be in a position to recommend the purchase of any quantity it may seem advisable to put to work. This will be within two or three months time, I anticipate.

Further, I am having a horse-power percussion drill made at our repair-shop, at Cradock, which, I think, will turn out to be an economical machine for work on the Karroo, under certain conditions.

134. If the plant is increased, your organisation all over the Colony will have to be enlarged. Is there any difficulty about that? Where is your head office in Cape Town, and is there accommodation for an increased clerical staff to deal with the great number of returns I see you make?—Should a large increase of plant be approved of, a difficulty might arise with regard to foremen for the percussion drills, which I should alone propose to add to the plant. This could be easily overcome by advertising for drill foremen in Australia, where, I am informed, there are many experienced men who would be glad to come to this Colony, owing to the

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depression of trade in that country. My office is in the Department of Public Works, Caledon Square, of which Department the organisation for the execution of the work of exploring and extracting underground supplies of water is a branch. Although some further accommodation is about to be provided, it is only sufficient to meet present needs, and would be quite inadequate for an expansion of the boring operations on the lines above mentioned.

135. Do you not think the present state of affairs very unsatisfactory, seeing there are a thousand applications behind, and what would you suggest in order to work off those arrears at an early date and gratify the wishes of the farmers by boring for them ?—There would be no difficulty whatever as long as there was money.

136. Are you taking steps to get money ?—That is hardly within my sphere. I have made suggestions that certain sums should be put on the Estimates. I have suggested that the estimates in this respect should be doubled, and next year I should suggest that they be trebled or even quadrupled Of course, I can do no more than that.

John McKechnie, examined.

John McKechnie.

137. *Chairman.*] You are foreman in charge of the drills ?—Yes, I am field inspector of drills.

138. You have put down a couple of boreholes at Matjesfontein, have you not ?—Yes.

139. You have gone through some dwyka conglomerate there ; very hard conglomerate, have you not ?—Yes.

140. What would be the average charge per foot, including everything, in the Colony ; speaking from your experience up to the present ?—My experience has been principally in the Transvaal, mineral boring. Just prior to the war it was about 18s. 6d. per foot for a two-inch hole. As the diameter increases, of course so does the price. In ordinary dwyka, such as we have at Matjesfontein, or in the Karroo shales, the cost would be from £1 to

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£1 5s. for a four-inch borehole; this would include everything.

141. You think that is a fair limit?—Yes, a fair limit. In igneous rocks such as dolerite or in quartzite the price of course would be considerably increased, but in soft sedementary rock it would pay well at 25s. per foot.

142. You have had considerable experience?—I have had ten years experience in the Transvaal, and three years in this Colony.

143. *Mr. Maasdorp.*] You talk about igneous rock. Do you ever proceed with the work at all when you come to igneous rock?—Yes.

144. Can you make any progress through dolorite? Is it worth while?—The idea had always prevailed in the Colony that immediately dolorite was struck the hole might as well be abandoned, as there would sure to be no water tapped. But it has been proved over and over again (I am speaking, too, from my own experience on the Rand) that even after a dolorite bed 600 feet deep has been penetrated with quartzite underneath, a good supply of water has been found. Even artesian wells have been struck where dolorite has existed.

145. It is quite practicable to go through dolorite?—Yes.

146. *Mr. De Smidt.*] Have you bored through dolorite in the Cape Colony?—I have met dolorite here, but have never gone through it to any depth.

147. *Mr. Wilmot.*] Is it your experience that the deeper you go the better supply of water you get?—That all depends where the water comes from.

148. But taking ordinary Karroo conditions, what do you think?—There has only been one deep borehole put down in the Karroo, to my knowledge. It has turned out a very good borehole. That is the borehole at Fraserburg Road. It would be a very good thing for the Government to put down a few deep holes just to prove what I say.

149. What would be the cost of boring through dolorite?—It would be very costly to bore a great

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depth of dolorite. I should say about 50s. to £3 a foot in dolorite. I do not suppose you would get any contractor to take it up at that price. It would cost the Government about that amount to do it.

150. *Mr. Van den Heever.*] If you bored down to a depth of 300 feet, could you get water anywhere? —It is very, very rare that you will meet with an absolutely dry hole. You can get from 30 to 50 gallons of water per hour almost anywhere. But then it would not pay the cost of putting the borehole down for that amount of water.

151. Is it not necessary to get an hydraulic engineer, or some other expert, for the purpose of going around the country to point out the sites most suitable for boring purposes?—Well, I do not know about that. I think that practical experience of men here in the Colony is very valuable. People who have been in the Colony for some time have more experience in finding water than any stranger.

152. *Mr. De Smidt.*] You mean the farmers of the country?—Yes, and people who have a knowledge of waterboring in the country.

153. *Mr. Van den Heever.*] With regard to an expert, do you happen to know of anyone whom you could recommend who would be suitable for such an appointment?—No, I do not know anyone just at present.

154. Have you had any experience of the gentlemen who go about with the wand, the divining rod?—I have spoken on the subject to a gentleman connected with St. Aidan's College, at Graham's Town. He used to experiment where I was working. His was a mechanical instrument, however, not a willow. On two different occasions it succeeded.

155. Do you think it would be a good thing to get one of those people with the divining rod to select sites for drilling?—I think a man with good geological knowledge and experience of the country would be preferable.

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156. You think then it would be a good thing to have an experienced man of the kind you speak of, who has a good local knowledge, attached to the drills for the purpose of showing the most likely sites where water might be found ?—The foreman of the drill is supposed, after having been in a district for a certain time, to have become familiar with the formations of the district; he is therefore considered to be able, and qualified to advise the farmer as to the best site to work the drill for boring for water.

157. But my experience is that some foremen know absolutely nothing about it. They know as little about it as the man in the moon and just put a bore down where the farmer wants it. Is not that so ?—If the foreman of the drill has any doubt as to finding water on the site selected, he has the power to advise the inspector of boring who would either send the assistant inspector or myself to select a site and to advise the farmer.

158. *Mr. Maasdorp.*] You sometimes refuse to put it down where the farmer indicates ?—Yes, if he indicates a place where the prospects are against the finding of water. For instance if it were dolorite formation.

159. *Mr. De Smidt.*] Have the farmers been successful in the sites chosen by them as a rule ?—Some have, others have not.

160. You cannot say the proportion ?—No, I cannot say the proportion. But the great mistake, as far as I know, is that the farmer won't go deep enough; he is afraid to spend money on it.

161. *Mr. Maasdorp.*] Afraid of the expense ?—Yes, afraid of the expense.

162. *Mr. Van den Heever.*] What depth can you go ?—With the old class of machine, we could not go any great depth. Now, however, with the more modern class of drill, you can go down to any depth up to 3,000 feet.

163. *Mr. Wilmot*]. That is the experience in Australia ?—Yes. And it has been proved in the Karroo. There is an idea that if you have to go

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down more than 300 feet in the Karroo no water will be found. But the two deep holes—one at Matjesfontein and one at Fraserburg Road—yield excellent supplies of water.

164. *Mr. Maasdorp.*] To what depth have they gone at Fraserburg Road?—I believe about 1,650 feet.

165. And they got a good supply?—Yes, a very good supply of water. The railway people there use it for their locomotives.

166. *Mr. De Smidt.*] Have you ever struck chalybeate springs in the Karroo?—No, never in the Karroo.

167. At Tambour's Fontein a spring was tapped about 15 feet underground, and another at Theekloof, near Fraserburg?—There must be thousands of artesian wells in the Colony. I may add that I have had a good deal of experience in Albany district, and that I consider this to be the worse district for water in the Colony. We put down a hole inside the grounds of Fort England Asylum. We went down about 700 feet, and only got 200 gallons per hour. It was very hard quartzite from the surface to a depth of 700 feet.

Tuesday, 21st July, 1903.

PRESENT:

MR. LOGAN (in the Chair.)

Mr. de Smidt.	Mr. van den Heever.
Mr. du Toit.	Mr. Wilmot.

The Hon. James Douglas Logan, M.L.C., examined (Mr. du Toit temporarily in the Chair).

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168. *Chairman.*] You have had long experience with regard to water boring in the Cape Colony, have you not?—Yes, I have brought two drills out to this country, and have put down a good many boreholes—a number at my own expense, but some on the Government principle.

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169. What kind of bores. what size?—All my wells have got a four-inch borehole. That is the smallest I have got. In fact, I do not think it would be wise to encourage boring with any smaller than a four inch, if you want to get a good supply of water.

170. These bores are all worked by steam?—Yes, all by steam.

171. How many have you?—I put down six at Matjesfontein and Tweedside.

172. At what depth?—To a depth of 419 feet at Tweedside, the yield being 50,000 gallons of water per day, rising ten feet above the surface. This was the deepest. The shallowest one was at Matjesfontein, through the Dwyka conglomerate, where we bored to a depth of 160 feet. At the Matjesfontein holes the water does not rise to the surface; it comes to within from fifteen to twenty-five feet of the surface, for which I have to use windmills. The last ones I struck quite recently; we could make no impression by pumping. It seemed to be a running stream underneath. It rose to within twenty feet of the surface; you could hear the water running quite distinctly underneath.

173. How many wells brought water to the surface?—I have only one at present, but I am busy with another one on the same farm.

174. *Mr. de Smidt.*] Were you successful in every case of boring?—I have never had a failure.

175. *Chairman.*] Do you point out the places?—Yes, I point out the places myself.

176. With regard to the managers or foremen, have you personally found that your experts have enabled you to bore successfully?—Oh, yes, if only we could keep good men when we have once got them. I am afraid that the higher wages that are offered to them tempt them to the goldfields where they get better paid. When they have learnt the art of boring and are acquainted with the different parts of the country, they go away on account of being offered better pay. I certainly think they are very much underpaid.

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177. Are you prepared to give evidence as far as yourself is concerned?—I am spending a good deal of money in water-boring, and this I certainly should not do unless I believed that it is one of the grandest things that we have in this country. In my opinion the Government are not doing half enough towards working off arrears, and meeting the wants of a number of farmers who are asking for drills. There are over a thousand applications from farmers to be dealt with, and I think that that state of affairs ought to be rectified. The only way would be to put money on the Supplementary Estimates. I would like to explain. We all know—certainly all sheep farmers know—what a large number of sheep have died this year on account of drought; and if better facilities were given to farmers for putting down boreholes it would, in my opinion, minimise the death rate during the summer months. Not only would it benefit the farmer in that way to a very large extent, it would also benefit the country generally by keeping in the Colony money which at the present time we are sending away for frozen meat.

178. Do you advocate Government boring or boring by private enterprise?—I think, for the purpose of working off these arrears, the Government ought to let as much as they can by contract, but they also ought to get more drills themselves. I think the present system is entirely wrong, with regard to the farmer.

179. That is, as far as the Government is concerned?—Yes. The farmer ought to know where his liability commences and ends. I am entirely in favour of paying so much per foot. Let the farmer know what he has to pay; he pays it, and there his liability ceases whether the boring is successful or not. We can go by results, of course, but I am afraid that would not be fair to the ratepayers.

180. When you say so much per foot, that does not matter how far the Government would go in the way of giving assistance?—That would be for

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the Government themselves. We were told by the Commissioner last session that the Government were prepared to pay two-thirds of the cost of the drilling, but I am afraid they are not doing anything of the kind. They are not assisting the farmer to that extent.

181. What share has the farmer to pay per foot? —The Commissioner told us last session that the Government were practically paying two-thirds of the cost. We have also received the information that the average cost is £1 per foot down to a depth of 500 feet. Therefore if the Government paid practically two-thirds, the farmer would have to pay about seven or eight shillings per foot down to 500 feet.

182. *Mr. de Smidt.*] What is the nearest distance between your boreholes?—I have three bore-holes within 150 yards of one another.

183. Have you found that the supply from the holes first bored are affected by subsequent boring in the same locality?—No, not those three.

184. Are you aware of any cases of that sort in connection with boring?—No, I am not aware of any.

185. *Mr. van den Heever.*] In what sort of ground have you bored? Through any particular kind?—The three holes I have just mentioned were through Dwyka conglomerate, all the same sort of ground—hard ground.

186.—Was it red or "vaal" stone?—It is bluish, with pebbles in it and pieces of quartz.

187. How many feet were you enabled to bore per diem through that kind of ground?—Of course it all depends. We bored about six feet per day through the ground I have just referred to.

188. With regard to the statement that boring costs about £1 per foot, do you agree with this?—I think it costs more than £1 per foot. I wish to make it clear that I do not mean for actual boring. I honestly believe that for actual boring, that is the time occupied, they could do it comfortably for 20 shillings. It is the delay that occurs through

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there not being money enough to have crowns ready for use when they are required. A fortnight ago last Saturday, a diamond drill started work on my farm Tweedside, but it has been able to work only three days up to the present; I have been waiting for a new crown all the time. This is what makes drilling so expensive.

189. *Chairman.*] You mean that it should be so calculated to allow for a good number of delays?—There ought to be no necessity for delays. I can quite understand delay through a crown breaking in a hole; accidents will happen. But the delays to which I refer are caused through negligence, not on the part of the farmer, but on the part of the Government through not providing sufficient money to have crowns ready, so that when one is worn out another can be put in its place.

190. Do you not think it advisable that the Government should fix a certain price per foot, of which the farmer should pay one-third, so that he would not be responsible for any delay or anything?—That is exactly what I say. One-third, about seven shillings; on the whole it should not exceed ten shillings. Otherwise it would be asking the farmer to pay too much.

191. By what are you guided as to the places where the borehole should be made?—I do not take any trouble to look. I have no knowledge of water-finding at all.

192. Then it has been a risk on your part?—Yes, at Tweedside I had two geologists down there, and they told me I would not get water on the spot on which we were standing. I said we would have a try. That is the place where I have now have 50,000 gallons a day flowing ten feet above the surface.

193. *Mr. Van den Heever.*] Are you acquainted with boring through the red iron-stone, dolorite?—No.

194. *Mr. De Smidt.*] You have no experience with regard to dolorite?—No, not in my part of the country.

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195. What is the character of the water obtained through boring at Matjesfontein and in the Karroo generally ?—It is perfectly fresh but sulphurous.

196. Does it smell of sulphuretted hydrogen ?—Yes.

197. Can it be used for any purposes ?—I drink it. If it stands in the dam some little while, everything evaporates.

198. For what other purposes is the water used ?—The water from the boreholes has enabled me to plant 75,000 trees. I have others at Matjesfontein, where I must have several thousand fruit and other trees. The water is also used for sheep, cattle, and horses. Certain places that I could not utilise before I am now able to utilise on account of having put down bores.

199. Is that generally the case in other parts of the Karroo ?—We have had so few drills and few opportunities given by Government of testing this part of the district. I believe, however, we would find water almost anywhere in the Karroo. The Government put down a borehole 1,504 feet at Matjesfontein ; I do not think they had much more water at that depth than they had at 300 feet. It was a test hole. During the time the troops were there, something like 3,000, I believe, they were all supplied with water from this bore-hole, also a greater number of horses and mules. There was a large steam pump going night and day for months and months at a stretch ; and it never reduced the well one bit.

200. Have you any other suggestions to offer or information to give with reference to boring ?—Of course the only important question, and the only thing that in my opinion would do any good is to recommend the Government to vote a very substantial sum of money on the Supplementary Estimates for this important work. I would also recommend not waiting till next year ; we should ask them to do it this year. They should get more bores out, and also give every encouragement to contractors outside to put down additional bores,

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and pay them so much per foot, as might be decided by the Government, and not hamper the Contractors with unnecessary restrictions.

201. Do you know whether the geologists in the Colony have expressed any opinion with regard to the finding of artesian water in the Karoo?—I could not say. I am told that until some test holes are made by the Government, they do not know very much about it.

202. *Mr. Wilmot.*] Do you not say that the benefit derived from the drill is an enormous benefit to the farmer by giving him an increased value for his land?—Of course. I am entirely in favour of assisting the farmer.

203 Are you sufficiently impressed by that idea in connection with the tariff? Do you want the tariff reduced?—Yes.

204. Do you think it fair that the farmer should pay half and the Government half?—The farmer should pay so much per foot, about a third, but not to exceed 10 shillings.

APPENDIX.

[A.]

MINUTES OF EVIDENCE.

SELECT COMMITTEE ON DIAMOND DRILLS AND WATER BORING APPOINTED BY ORDER OF THE LEGISLATIVE COUNCIL, 10TH AUGUST, 1899.

Tuesday, 5th September, 1899.

PRESENT:

MR. J. D. LOGAN (Chairman).

The Treasurer,
Mr. Maasdorp,
„ Ross,
„ de Smidt,
„ Pretorius.

Mr. Smith,
„ van Rhyn,
„ van den Heever,
„ du Toit.

Mr. Joseph Newey, examined.

1. *Chairman*] You are Chief Inspector of Public Works?—Yes.

2. And you know the object of this Committee, namely, to get all the information we can with regard to water boring?—Yes.

3. I take it that you have had a good deal of experience in connection with the subject, indirectly, if not directly?—I am not a specialist in the matter of water boring, but it is a detail in the engineering profession.

4. The Committee will be glad of your opinions and any information which you think may be useful with regard to deep or shallow boring, as the case may be, anything that may be of use for procuring water in the dry parts of the Colony?—We have the machinery in our Department for doing the work, but we have not been called upon to do it hitherto; the practice has been simply to comply with the applications made from outside by private individuals (or public bodies).

5 What are the terms on which bores are given out to private individuals at the present time?—There are two arrangements, one by which the drills are sold to applicants on the £ for £ principle, and another where we simply charge the salary of the foreman who works the drill, the applicant finding all the labour and moving the drill from the last farm to his own.

6. Is there any particular class of drill referred to in supplying the outside public with these drills, or is there any particular expense to which the Government are prepared to go ?—No. We deal sometimes with special cases, but, as a rule, the applicant gets practically what he asks for so far as it can be done under the regulations.

7. Are you in favour of the present system of farmers supplying the labour going on in the same way as is done at present by the Government, or would you prefer the farmer paying so much per foot, and all further liability ceasing, the whole of the working arrangements being in his own hands?—No. We may be called upon to put down a bore simply on the application of a farmer in a dry place, where there is no hope of getting water, and run the risk of paying more than half the expenses, with no prospect of benefiting the State.

8. Suppose a farmer is prepared to pay a certain sum for every foot you go down, without there being a condition of finding water?—I am afraid that we should then often be tapping the Treasury to satisfy the curiosity of the farmer.

9. What do you do now?—Very much the same thing, but not to the same extent.

10. *The Treasurer.*] What is the greatest depth you can go with your machinery?—We can go down to 1,400 or 1,500 feet if necessary.

11. With what sort of a drill is that?—A diamond drill, worked by steam power.

12. When did you get that out?—Mr. Logan had something to do with getting it, one of the largest, out

13. What sort of pattern is it?—I cannot very well describe it, but it is not the orthodox pattern, like those now used in the Department.

14. You have none of those drills, have you, which go down 3,000 or 4,000 feet?—We could apply suitable parts to the drills we have for that purpose, that is, the steam power drills.

15. So as to go down 3,000 or 4,000 feet?—Yes.

16. Which drills?—Our larger diamond steam drill.

17. Have you got the machinery now in your possession which would enable you to go down 3,000 or 4,000 feet?—No, we should have to import the other parts.

18. What would such a drill cost?—I cannot tell you offhand, but I will supply the information. A Sullivan drill for deep boring to 5,000 feet will cost £2,000 in the Colony.

19. What is the average cost on the Rand of going down to these great depths?—It is very difficult to get information as to that. Extensive deep boring has been carried on in the Transvaal, especially on the dip of the Rand main gold reef. The bores vary from 1,000 to 5,000 feet, and are chiefly through hard rock.

20. The cost you do not know?—The Sullivan American diamond drill, the one used at the Rand, has been found to be the most expeditious and economical. The cost of piercing the harder rocks is about 40s. per foot in depth, and the softer about 30s. per foot. That is on the entire depth of 5,000 feet. It varies according to

the depth and situation of the reef. These prices are an average of a large number of holes of various depths through different material.

21. Are those drills owned by companies or are they in the possession of contractors?—I cannot say, but think they are all owned by boring contractors.

22. You are aware that deep boring has been carried out extensively in Australia, are you not?—Yes; I can give some information of the experience in Australia.

23. What sort of drill do they use there?—Experience is not the same in all parts of Australia. Bore holes in great number have been put down in Queensland in search of artesian water, and they have been most successful in the great artesian areas that exist in that country. Roughly, 550 holes have been sunk of an average depth of 1,100 feet. Only 50 of these have been done by Government, the rest are the result of private enterprise. The successful holes number 350, and have an average combined yield of 186,000,000 gallons flowing at the surface. The deepest hole is 5,976 feet. Unfortunately a proportion of this supply is not fit for stock nor agricultural purposes owing to its containing salt or other chemical properties.

24. You do not know the style of drill they use there do you?—I have not made a note of that. It is bound to be the diamond drill for penetrating strata.

25. Is it not what is known as the jumping drill?—There are different drills for going through different strata. In New South Wales they have put down about 80 holes, of which about half flow at the surface. There are about 100 private artesian bore holes yielding 38,000,000 gallons daily. The shallowest hole is 114 feet, the deepest 3,152 feet, sunk by the Government at an average cost of three shillings per foot. The Government of South Australia, sank 60 bore holes for water, the deepest of which was 3,000 feet and the shallowest 242 feet. About half the number yielded salt water, not fit for stock, and only 20 yielded fresh water. Western Australia has only recently taken up the question of boring for water, but have been successful with the few holes sunk. The Government have put down four or five holes and private persons about the same number. These are from 200 to 1,400 feet deep, and have an average yield of 100,000 gallons per diem. The Government of Victoria have expended large sums in exploring the country in search for artesian water, but unfortunately the geological conditions do not seem favourable, and so far no success has attended its efforts. The boring machinery used in Australia is generally of the jumper type (the Canadian pole drill worked by steam being the favourite), as the formations are more loose in the artesian areas. Diamond drills are more especially used for searching for minerals, but a rotary drill, made in England, which uses both steel and diamond cutting tools—the one I referred to a little while ago—has had a good deal of success, and claims to have put down a hole 1,100 feet deep through sandstone and shale at a reported cost of 3s. 9d. per foot of depth.

26. Is there any artesian area that you know of in this Colony?—

Only Table Mountain and a few ranges in the neighbourhood. The southern slopes of the Drakensberg, here and there, might produce artesian water, but there it is not necessary, as there is sufficient in the rivers. The slopes of mountains draining into the Breed and Oliphants Rivers might yield artesian water.

27. *Mr. Maasdorp.*] Are you hopeful of finding artesian water in the Karoo districts?—I am not, personally, not at a great depth.

28. Would you be in favour of deep boring?—Not for water in the Karoo districts generally. There are isolated cases where water could be brought to the surface with advantage to the person using the water, but whether it would be to the advantage of the country generally is another thing. I am rather doubtful.

29. As far as boring has gone up to the present, do you consider that it has been attended with success?—Yes; that is, the boring itself has been a success, and taking it altogether, a sufficient quantity of water has been brought to the surface to warrant the expense of the boring, but I do feel that all this time while we have been drawing water from where it is locked up at such depths, and pumping it to the surface, we have simply been bringing a large proportion to evaporate, and lowering the water table; that is to say, the level of the underground water, and making the surface ground more thirsty.

30. *The Treasurer.*] Have you any proof of the lowering of the table?—We have not been working long enough either to cause or observe a perceptible lowering.

31. You give an opinion—have you anything to support that opinion?—I only give it as an opinion.

32. But you have nothing to bear it out?—No. I should, however, explain that the surface of the water table, taken either locally or generally, is always rising and lowering. It is raised by the rainfall and lowered by the natural gravitation of the water to lower levels, and any acceleration of drainage, such as by boring, is sure to lower the surface level either locally by inducing what is called a watercore or cone depression, and generally by lowering the surface to a lesser degree over a large area. If an underground water is reduced in bulk the difference, however small, is most likely to occur on the top; hence the expression—the lowering of the water table.

33. Not the least?—No. I have seen what I once knew to be flourishing river valleys, with healthy trees, drained out by some process or other, not accountable for by the seasons, to such an extent that the trees have died.

34. Where is that?—In the Ladismith and Swellendam districts.

35. They have had very protracted droughts there, have they not?—Yes; but I speak of three or four years ago.

36. *Mr. Smith.*] Are there many artesian wells there?—No.

37. *The Treasurer.*] Have they any?—Not that I know of. I had no interest in the matter of water boring at the time.

38. *Mr. Maasdorp.*] I suppose you are of opinion that the conservation of surface water would be more profitable to the country than boring for water?—Yes, that is my opinion; and it would

tend to raise the water table and make boring more profitable where it was necessary and in most cases unnecessary.

39. I suppose you would consider that the two should go together, would you not ?—Yes; because there are cases where one system would be applicable and cases again where the other system would be applicable.

40. Do you think the work has been sufficiently encouraging to warrant the Government in incurring much more expense in connection with these water bores ?—There are a great many applications on hand, more than we are able to meet, enough, in fact, to keep us going with the present plant and staff for two years, if we had no other applications. While, however, these applications are coming in, and the farmers are willing to put their hands in their pockets and pay a share of the expense themselves, I think the Government should meet them.

41. Do you not think the droughts which the Colony is suffering from at the present time may account for that—that it is really a sort of forlorn hope; they are running short of water, and will do anything to get a supply, and the first rains we get will change the whole course of their thoughts in that direction again ?—I do not think that those who have succeeded in getting water will regret the expense they have gone to, no matter what the season may be. I do think in most cases where water has actually been brought to the surface and pumping is not required, where it is used for the irrigation of a garden or for watering stock, or even for watering a small patch of land in the neighbourhood of a house, it is in the interest of the person who makes the application derives all the benefit and shares the expense.

42. *Mr. Smith.*] Can you give the Committee any idea of the cost per foot of the boring done by the Government up to the present time ?—Do you mean charging only the Government's share of the expense ?

43. No ; the entire cost ?—It has cost the Government as follows: 3-inch steam power, 8s. per foot, and the farmer about 4s., that is where rock is encountered at considerable depth ; 2-inch hand power drill, 6s. and about 2s. 6d. per foot ; and 3-inch jumper drill, 5s. and the farmer about 2s. per foot. I may say that this expense to Government does not mean the actual cost of boring through the ground merely, but it also includes the cost of the foreman's and enginemen's time between places, towards which the farmer pays nothing.

44. That is the amount paid by the Government ; the farmer pays equally as much ?—It costs us more than that, as we have to bear all the delays and disappointments and little uncertainties. The farmer does not pay any of that, he simply pays the fixed charge of 10s. for hand power and 15s. for steam drill.

45. *Mr. de Smidt.*] In sinking bore holes departmentally, is the officer in charge instructed to record the geological formation pierced and the character of the water obtained ?—Yes, in all cases. We have forms which have to be filled in, giving the information we require. Next year I hope to be able to publish all that information with regard to every hole.

46. Are those results submitted for expert examination?—The water where at all doubtful is submitted to the analyst of the Agricultural Department, and it is our intention to publish the results in every case.

47. *Mr. Smith.*] A bore hole was put down in Bechuanaland on ground belonging to the Smartt syndicate; did you send in particulars of that?—Yes; reports were sent in on November, 1897, and November, 1898. Borings were made on three farms. On one no water was found, on another (Buckreef) 21,600 gallons per day, and on farm (Lawn) 10,000 gallons per diem were obtained near the surface.

48. *Mr. Pretorius.*] Will the bore that pierces the soft rock answer for the hard rock?—We use a different tool to go through different kinds of ground. It is only when we come across hard firm rock that we use the diamond drill; other tools deal with softer rocks, and gravel and earth formation.

49. *Mr. de Smidt.*] Do they go through dolorite?—I would not from choice attempt to go through dolorite to seek for water, but if it is necessary, the diamond drill would go through it.

50. *Mr. Pretorius.*] In my experience some of these bores when they have gone down about 50 feet through soft rock, as soon as they come to hard rock, they have stopped work; I should like to know whether it is the bore cannot do the work, or whether the men are incompetent for the work?—When they come across dolorite, it is useless to seek further for water. If there is not water then, it is no use going further.

51. Is it your opinion that underneath this hard rock no water is to be found?—That is so generally.

52. Are these men competent to judge whether it is dolorite or ordinary rock?—Generally in that case they look at the surroundings and surface indications, and if they are not satisfied, they would refer the matter to the inspector who goes round and inspects every foreman. He is a man competent to deal with the case. Many such cases are recorded.

53. I know of instances where the work of the diamond drill has been stopped and the owner of the property has employed jumpers, and they have succeeded in finding water after those in charge of the diamond drill have stopped the work and thought it unnecessary?—I should be glad if you would give me any instances of that, or report it to the Public Works Department.

54. Have you any suggestions to make as to Government terms for assisting farmers in boring for water?—I had something to do with suggesting the present regulations, and as far as my experience has gone, they seem to meet the requirements.

55. *Mr. Smith.*] Do you think the Government would be justified in putting aside a certain sum every year for testing the Colony in several parts for water, in the will represent my views on that and other kindred subjects it myself under the present condition of the Treasury. It seems to me that expenditure is more necessary in other directions.

56. Do you consider the Government would be justified supposing the Treasury was overflowing?—Yes. I have given a good

deal of attention to the matter, and I may say that the report which will shortly be published will represent my views on that and other kindred subjects with regard to hydrographical survey of the country.

57. *Mr. du Toit.*] Have you any suggestion to make regarding the terms on which the Government should assist farmers?—I consider that the present regulations meet the case.

58. Are they fixed regulations?—Yes; they are published, and available to everyone.

59. What size bore would you recommend in this country?—Every situation requires special consideration.

60. You think that every place must be considered on its merits?—Yes.

61. *Mr. van. den Heever.*] How many men are required for a bore?—It depends upon the conditions; the kind of drill used and so on. We supply the foreman and the farmer supplies the rest in the case of hand drills; in the case of steam drills we supply also an engineman.

62 Usually how many men does it take?—Four or five men would be necessary for a hand drill, four for turning the drill alone.

63. Does the Government supply those?—No; we supply the foreman only. The farmer supplies the other men.

64. How many men would be required for a bore intended to go down 150 or 200 feet?—If it were a steam drill, perhaps five or six men would be required. Much depends on the kind of fuel available.

65. What is the prevailing depth at which water is usually found in the Colony?—I may say that that is all published in my annual report. The experience ever since boring was commenced by the Government will be found there with the exception of three cases. The first is Tweedside, near Matjesfontein. The results of holes made by the Railway Department are: depth, 426 feet; diameter at the surface, 7 inches, and at the bottom 4 inches, and 50,400 gallons of water per diem come to the surface. The water in this case does not only rise to the surface, but it is able to rise 16 feet above the surface, where a tube is erected for it to rise in. At Grootfontein the bore is 164 feet deep, and 4 inches diameter all the way down, and yields 25,000 gallons of water per diem by means of pumping.

66. *Mr. Smith.*] Is that hole lined?—Only through the soft stuff. Is it all rock there. At Grootfontein the 4-inch bore hole yields 25,000 a day, but it does not rise to the surface; pumping is required.

67. What depth above the grass does the water rise at Grootfontein?—It does not rise to the surface, but requires pumping. I do not know exactly the water level below the surface, about 6 feet.

68. *Mr. de Smidt.*] Can you say whether that bore hole has a casing?—No; it is through hard rock. At Prince Albert Road the bore is 475 feet deep; the diameter is six inches at the top and 4 inches at the bottom, and the yield is 35,000 gallons a day. The

water is pumped out; it does not rise to the surface.

69. *Mr. van den Heever.*] Is there any way of finding whether the water runs in certain veins?—It certainly not only runs in veins, but it is locked up in the porous rocks and gravel formations.

70. Do you consider that you would find water anywhere by going down to a certain depth?—No.

71. Have the men who work the drills sufficient knowledge in your opinion to judge for themselves whether a certain spot is one where they are likely to find water, or do they merely bore where the farmer tells them to bore?—In many, I may say in all, cases they consult with the farmer, and if he insists upon having a hole in a certain place against their judgment, they consult the Inspector, who gives the farmer another opportunity of insisting.

72. Do you not think that the time has arrived when an expert, with a knowledge of water finding, should be appointed to superintend the bores?—Any competent engineer who has studied his profession understands the matter. We have no one who is regarded as what is called a "water-finder"—a sort of witch, who professes to do something supernatural.

73. Will you put in a return showing the amount of work done by the bores, the number of holes bored, and the number of bores in operation?—It is all in my annual report; but I shall be happy to put the information in a form which will answer the question. See Annual Report of C.I.P.W., G.53—'99, Appendix R, Table No. 1, page *cxxxvii.*

74. Do you think the Government ought to give bores to farmers on easier terms than at present?—No. I had something to do with drawing up the present regulations, and I consider them fair, as far as our experience goes.

75. What is about the cost per day to a farmer who has to supply three assistants, counting fuel and everything?—We have not consulted the farmers as to what it costs them. I presume they have servants on their farms whom they divert, for this kind of work, from other work. I think that 10s. a day on the average should cover it, or even less than that.

76. *Mr. van Rhyn.*] Are all the deep borings in this Colony a success, or are some of them failures?—I think only one is a real failure; but we have not done enough deep boring to speak from experience.

77. You are in favour of deep boring, I suppose?—No, not for water. There are one or two favourable cases where deep boring would answer, but generally I am afraid it would not.

78. In my district, Namaqualand, they sink wells and get water at 50 or 60 feet, but it is salt. Could you bore through the salt water and get to fresh?—The salt water is heavier than the fresh water, and the fresh is bound to be on top. By plugging the bore hole below the salt water level, you might succeed.

79. Have you any expectation that you could go down deep enough for fresh water if you stopped the salt water above?—There are not many instances where we have stopped on account of brak water. We have had no occasion to go down beyond that.

80. Do not you think it would be an advantage if Government

were to go in for boring on Crown lands, especially in the Calvinia and Namaqualand districts, where there are large tracts? If there were a good supply of water, would it not improve the property and make it more valuable, whereas it is of very little value now without water?—I consider that the Government should always improve the condition of the land where good opportunities offer by water storage or other works before it is sold, and sell it, or rather lease it, with the improvements on it. Those are the lines on which I am working in dealing with large irrigation works.

81. Have you seen much of the north-western districts?—No.

82. Do you not think the Government should try a few experiments there?—I am hoping to travel through that district shortly, and will then consider the question on the ground.

83. Then you will be able to make a report? Yes.

84. Would not boring with steam power be very expensive for farmers?—Yes, it would be expensive, but they would get all the benefit. Nobody will get the benefit if they do not.

85. It is just a venture, is it not?—Yes.

86. *Mr. Ross.*] Are there any other suggestions you would like to make?—Please see Annual Report, C.I.P.W., G.53—'99, Appendix R., page *cxxxv*.

Wednesday, 6th September, 1899.

PRESENT:

Mr. J. D. LOGAN (Chairman).

Mr. van Rhyn,	Mr. du Toit,
„ van den Heever,	„ Smith.
„ Pretorius.	

Mr. Harry Saunders examined.

87. *Chairman.*] What are you?—I am a boring engineer, residing in Cape Town.

88. *Mr. van den Heever.*] Can you tell me what is the average cost of boring from 60 to 100 feet, say?—I can give you the cost exactly during the time that I was Inspector of Water Drills. The holes rarely exceeded 100 feet, and in 1893 the average cost per foot was 7s. 11d., in 1894 9s. 1d., in 1895 10s. 2d., in 1896 9s. 11d., and in 1897 9s. 6d. This was drawn up by the accountant of the Agricultural Department after carefully going into the matter.

89. Is that the whole cost?—Everything so far as the cost to the Government is concerned, except the cost of the machine; but it includes the cost of diamonds, the cost of keeping the drills in order, the cost of material for renewals and repairs, foreman's wages, salaries of the head office staff, transport travelling expenses, and contingencies.

90. Is it under 10s. a foot on the average?—Yes.

91. And, including the cost to the farmer, how much would it come to?—Under £1 a foot for everything; in fact, I should think the farmers could do it themselves for 15s. a foot.

92. Including everything?—Yes.

93. What is the general depth of the water?—About 45 feet in the Upper Karoo, and all about Colesberg, Steynsburg, Venterstad, and all those places. That was the average depth when I was in the Government service. The water to a certain extent flows above the ironstone; it flows down till it meets the dolerite. Sometimes you get a crevice that appears to be almost a pipe. You can get water anywhere above the dykes, but not below the dykes as a rule.

94. Running water?—Yes; along the dyke.

95. Do you not think that the men in charge of the drills are always sufficiently competent?—It is necessary that every man in charge of a machine should be competent, and that he should have a general knowledge as to where the water is. As a rule, if you go into a district, the water is almost the same in every spot.

96. Have you found that?—Yes. I may say that there are some men who simply know nothing whatever about the matter, but that, I maintain, is the fault of the Government. They cannot expect to get a competent man for £12 a month.

97. Do not you think it would be a good thing if the Government were to appoint an expert, in order that water boring may be successfully prosecuted?—It would certainly be advisable, where the foreman is incompetent, but I think that as a rule the farmers know as much about water, and a great deal more in some cases, than the men in charge of the drills.

98. Do you think it would be a good thing if a water-finding engineer were appointed in order to find the best sites for boring? —Yes.

99. *Chairman.*] I take it from your remarks that you thoroughly agree with the diamond boring for water?—Yes, undoubtedly.

100. Do I understand you to say that, taking it as a whole, if it was prosecuted on a large scale, the efforts would be more or less crowned with success?—Yes, undoubtedly. I am speaking, of course, absolutely from my private experience, and I may say that I have got water everywhere. At Ohlsson's Brewery, at Newlands, there are 100,000 gallons a day flowing three feet above the surface: at the Tramway Station, by pumping 40,000 gallons a day, at Sanderson's by pumping 50,000 gallons a day, and indeed all over the place.

101. Are you in favour of small drills or those of a large bore? —The larger bore undoubtedly; there is no question whatever about it. We put, as a private firm, down no bore under 6 inches now.

102. In the event of the water not flowing, under those circumstances, you could get a good-size pump in order to obtain the water, could you not?—Yes, a pump that would pump from 50,000 to 100,000 gallons a day out of a 6-inch hole.

103. With regard to the mode of boring and the amount paid by the farmer, do you think it would be very much better if the farmer had to pay so much per foot, say, up to a certain distance, and let the Government man or whoever it is come and put down a hole entirely on his own responsibility?—I would even go further than

that, and say that I think it would be far better if all the boring were paid for by results. As a private firm, I may say that we guarantee water; in the event of our not finding water, those who employ us do not pay us a penny. We are perfectly prepared to undertake work on those terms in any part of the country; we will bore a hole at so much per foot, and if we do not get water the farmers do not pay us anything. We do that throughout South Africa.

104. There is another thing; when you go to a farm to start work, the farmer has to provide his boys; have you not found at times that they are very unhandy?—Undoubtedly. It is the greatest mistake in the world to employ them, as I have urged this upon the Government, and to a certain extent I had my way, as they did give us a foreman and assistant. There should be a proper staff of three boys, a foreman and a workman for ordinary 4-inch holes, and they should be taken round from place to place. We have some boys who have been with us ever since we started, ten months ago.

105. Do they understand the work?—Yes. The only thing is, that a farmer sometimes objects to having strange boys on his farm; but the work is got through much more expeditiously, as I have proved.

106. *Mr. Smith*]. You remarked just now that you thought it the best plan to pay by results?—Yes.

107. Do you mean by the Government as well as privately?—Yes. If we can work as private individuals on such conditions there is no reason why the Government should not have competent men. It is a very easy matter to find water almost anywhere, and if there is payment by results it is a good thing all round, as it spurs a man on. If you find a foreman not getting water you enquire into it.

108. Are you of opinion that it would be a good thing for the Government to test certain parts of the country for the purpose of gaining information in the direction of defining water strata?—I think, to a certain extent, it is tested. Of course there are various parts that have not yet been tested, and that should certainly be undertaken by the Government—any new work. It would be for the man in charge to go round and express his opinion whether he thought that water would be struck. If he thought there was no chance, then the Government could not undertake the work on those terms.

109. You think it would be a good thing on the part of the Government to send round and make trials in the drier parts of the country, put down, say, two holes at least in each district, so as to attempt to define the underground flow of water and to enable the farmer to decide whether it was worth his while to go to the expense of boring or not?—A few holes might be put down on Crown lands, but it would be difficult to put them down on private farms.

110. Every man, of course, would try to get a hole put down for himself. The difficulty, however, might be overcome if, where the configuration of the country was favourable and pointed to the

fact that water would be found there, an arrangement were made with the farmer that if the boring were successful he should pay for it ?—That was what I suggested, that farmers should pay by results. It would be rather hard on the surrounding farmers to select any one particular farm to put down a hole on.

111. You think that the Government should confine it to Crown lands ?—Yes. Work has been going on on the railway extensively, and that department ought to be able to give very valuable information now.

112. But the railway does not touch the North-western Districts to any extent, does it ?—In the north-west there is plenty of water, but very little has been done there, however. It costs so much to transport the tools, but if the Government were to bear all the expense and pay by results, there might be a good revenue. Another thing is, that it should be conditional that the smallest size hole they put down should be three inches.

113. You think that three inches is the most useful size ?—Three inches should be the minimum diameter. As a private firm, we make no difference detween a two and a three-inch hole in solid rock as regards cost.

114. *Mr. du Toit.*] Can you furnish the Committee with a report as to how many holes you have bored with success in each place ?—That is already in my annual report from year to year. I shall be happy to give it for the last year in my private work. My operations have been confined to the Cape District so far. The Government returns show all the official work.

115. Do you think it would be a good thing if the Government were to supply bores, when applied for, and with the bore a head man or inspector, payment only to be made if water is found ?—Yes.

116. *Mr. Pretorius.*] Do you know of instances where water has been found, and then after a time it has disappeared ?—I never found that. It might be the case with the flowing water in the Upper Karoo ; where it is surface water, it will lower, but I have known a few places where it has sunk two or three feet in the dry season, but it has not gone away altogether.

117. Do you know places where the water has disappeared through using dynamite ?—Yes. If you use dynamite it makes fresh crevices in all directions, and the water will go away. Dynamite should not be used in the neighbourhood of a spring.

118. *Mr. van Rhyn.*] You are aware that in the remote districts there are large tracts of valuable Government land — Calvinia, Clanwilliam, and Namaqualand—without water ; do not you think it would be a good thing if the Government undertook to bore there in a few places, with a view to finding water ?—Yes, most decidedly. The more boring that is done the better for the country.

119. On Government ground ?—Yes.

120. Would it tend to improve the value of the land?—Yes, undoubtedly ; and it would also induce private parties to go in for boring, which is really the main thing.

121. *Mr. Smith.*] Have you any other suggestions which you

would like to put before the Committee?—Yes, but with permission of the Committe I will send a reply later on. (Vide Appendix A.)

Mr. John Coverdale, examined.

122. *Chairman.*] I believe you are a boring engineer, in charge of the railway borings?—Yes.

123. Have you had a good deal of experience in matters of this kind?—Yes, for about twelve years before I came here.

124. What countries have you visited?—In New South Wales I was engaged in boring for water and coal, and also in Central China.

125. I suppose you have done similar work in England, too, have you not?—Not boring, because there is very little boring done in England; it is so well known—every foot of it.

126. How many bore holes have you put down since you have been in this country?—At Matjesfontein, Tweedside, Grootfontein, Prince Albert Road, and Klipplaat.

127. Have you commenced any bore holes in which you have not found water at these places? —Not yet.

128. You have got water at every one?—Yes, a good supply at everyone.

129. The bore hole at Tweedside has been mentioned; what supply of water was coming from that bore hole?—50,000 gallons in twenty-four hours.

130. That is flowing from the surface?—Yes; it flows about 10 feet above the surface.

131. When you were down about 60 or 80 feet, did you get salt water?—At 35 feet we got brak water.

132. What steps did you take to shut that off?—We tubed it off with seven inch pipes, and cemented it between the wall of the bore and the piping with Portland cement.

133. And that shut off the supply?—Yes.

134. And then you went down how deep?—426 feet.

135. And you got 50,000 gallons a day?—Yes.

136. Can you state approximately what was the cost of that boring at Tweedside; how much per foot was it for the 426 feet? —It cost rather more than you said. It costs 16s. 8d·92 per foot, nearly 16s. 9d. The total cost was £356 12s. 9d., including wear and tear, diamonds, and everything.

137. Was that all actual working time?—The whole time that the drill was there.

138. As a matter of fact, the drill stood there for some considerable time without doing any work, did it not?—We had not diamonds, the Public Works Department had our diamonds, and there was some correspondence going on about them. We had only sufficient diamonds for Grootfontein. As soon as that was finished we went on with Tweedside. We went down 80 feet with steel tools first.

139 That was a nine-inch hole, I believe?—Eight inch.

140. How long would the engine be standing there without working?—I cannot recollect.

141. Approximately. Was it six weeks or two months?—Some few weeks.

142. Then you are actually charging for expenditure when no work was going on?—Yes.

143 If I were to say that the actual price of the work done in that hole did not exceed 15s. per foot, would it be correct or not?—I suppose it would cost less than that if we had gone straight ahead.

144. Then the actual price would not be over 15s. per foot, would it?—Probably 11s.

145. Are you in favour of diamond boring?—Yes; in this country I am in favour of diamond boring certainly. Owing to the formation here the Canadian and American drills would not answer; the rock is too hard. In places they can go a few feet here and there; but there is hard, indurated sandstone in the Karoo.

146. What sized holes would you recommend, small or fairly large?—Large bore holes, by all means—say, six-inch holes for farms.

147. What is your reason for that?—They cannot get the water up. Many farmers come to me in Prince Albert and Klipplaat, and said they had 2½-inch and 3-inch bores, but they could not get the water up properly, the pump not being big enough.

148. Your experience is, that up to the present you have never put down a bore hole without getting water?—No, not yet. Of course in other countries they have 8 and 10-inch bore holes. In Australia it is 10 inch.

149. *Mr. Smith.*] Have you ever been in Paris? There they have bore holes up to 14 inch?—I have not been there.

150. *Mr. du Toit.*] What is the average depth to which you can go with the diamond bores?—The formation governs that. Of course if you have a solid formation in shale and sandstone, you can go down 10 or 11 feet a day; but the question is a difficult one to answer, because if the country is broken, it necessitates lifting the rods and commencing again, as the core breaks and jams.

151. Then it all depends on the soil?—On the formation. In the lower Karoo, I say bore as deep as you like, and the more water you will get.

152. Have you been boring at all in the north-western districts?—I have only been boring for about two years in the Lower Karoo. I am getting out of it now, and shall get up to the other side of Beaufort. From 500 feet in the Lower Karoo up to 800 feet you will find water. There are two kinds of sandstone there; you have the bar or reef indurated blue sandstone, and then you have the buff-coloured free sandstone. That is where you get the water, in the free sandstone. The deeper you go down, the more water you get in the Karoo.

153. Have you always found that in boring you can get water on the surface of the land?—No; you cannot expect that. You are fortunate if you do; but you must use a pump.

154. In every instance?—Not in every case. In the artesian well at Tweedside the water is flowing, and of course in this country

there are many places where you get it flowing.

155. *Mr. van Rhyn.*] The hole you bored 426 feet, was it on private land ?—Yes. It is near Matjesfontein.

156. You say that the cost was 16s. 9d. a foot; does that include everything ?—Yes ; but the total cost came to about 11s. a foot.

157. What sized drill do you prefer, a big one or a small one ?—Six inches for the first 150 feet, and then four inches and then you can use either a steam or windmill pump.

158. What kind of pump do you use in order to bring up the water from such a depth ?—A deep well lift pump.

159. Will that bring the water up 400 feet ?—Yes ; but it would take a lot of work to lift the water 400 feet. You can either use a windmill lift pump or an ordinary suction steam pump.

160. *Chairman.*] I take it that you are entirely in favour of deep-well boring ?—Deep boring in the Lower Karoo. I do not know about the Upper Karoo. I have not been there. For the Lower Karoo certainly.

161. *Mr. van Rhyn.*] Do you not think it would be a good thing if the Government were to undertake to bore for water by way of experiment on one or two Government farms in the remote districts ?—Yes, certainly.

162. It would improve the value of the land, would it not ?—Yes ; and if they were to go in for deep boring for coal, it would also improve things.

163. If you bore for water perhaps you may find coal, may you not ?—Yes. In other parts of the world the Government always try to discover minerals for the people.

Tuesday, 12th September, 1899.

PRESENT :

Mr. J. D. LOGAN (Chairman).

Mr. Pretorius,
„ Van Rhyn,
„ Van den Heever,

Mr. de Smidt,
„ Ross.

Mr. John James Raymer, examined.

164. *Chairman.*] You are in the Public Works Department ?—Yes.

165a. You know the object for which this Committee has been appointed ?—Yes.

165. What experience have you had in diamond boring ?—I have had five years' practical experience.

166. How many holes have you put down during the five years ?—I have not the exact number.

167. Can you give it approximately ?—I think on the average I have attended about eleven farms in each year. I usually bore three holes on each farm.

168. Can you give the Committee any information as to the results : how often have you been successful, and how often have

you been unsuccessful in getting water ?—I have the results for the first two years, when I was boring at Middelburg. As regards the rest, I could not get my diaries ; they have always been handed over to the man in the Public Works Department, who has taken charge. As regards the Middelburg district, in the years 1893 and 1894, 56 bore holes were sunk, and 42 of these yielded water. Out of 24 bores, the daily yield of flowing water was 538,620 gallons per diem ; 19 holes were tested with a pump, with a total yield of 215,260 gallons a day.

169. What is about the average depth you went to in order to get these supplies ?—Between 16 and 164 feet. That was in the Karoo Midlands.

170. What kind of a drill did you use ?—Both steam and hand power. In this case it was hand power I may mention.

171. What was the diameter of the hole ?—2⅛ inches.

172. Are you in favour of a large hole or a 2⅛ inch hole ?—For prospecting purposes, a 2⅛ inch hole is quite sufficent, and also for flowing water, but for deep boring, where a pump has to be used, a 2⅛ inch hole would of course be too small.

173 Therefore you are in favour of using larger drills, are you not ?—Yes.

174. If you use a larger drill you require steam power for the purpose, do you not ?—Yes. I think you will find from the annual report that there are 12 steam drills in use now.

175. *Mr. de Smidt.*] What is the greatest depth you have gone down ?—164 feet.

176. With what result ?—In this instance the water rose to within a few feet of the surface, and the hole was enlarged from 3 inches to 6 inches, for the purpose of putting up a large pump for irrigation purposes. I may mention that the bore hole was tested, and the supply was very strong. This was in the Colesberg district.

177. Do you, as a rule, record the strata through which you bore ?—I do.

178. *Mr. Pretorius.*] You say that you have bored in the Middelburg and Colesberg districts ?—Yes.

179. For how long ?—I was three years in the Middelburg district.

180. For how long have you been boring altogether ?—I have had five years' experience.

181. To what depth have you bored in the Middelburg district ?—In the Middelburg district the deepest bore hole was between 60 and 84 feet.

182. Have you found water at 84 feet ?—Yes ; the bore hole gave 60,400 gallons a day of running water.

183. On what place was that ?—Droogefontein.

184. Do you know the farm Doornhoek ?—Yes ; I have bored there.

185. Have you found water there ?—Yes ; I had the strongest water there ; 180,000 gallons a day for ten months ; and after that it decreased very rapidly.

186. What was the reason of that do you think ?—I attribute it

to the periodical droughts. I may mention that this is not the only case in point. I have put down a great many bore holes, not only in the Middelburg district, but in others, during my five years' experience, where the flowing water has decreased, and in a great many instances it has ceased flowing altogether in times of drought.

187. Was not the hole deep enough ?—Yes ; but the formation was so hard.

188. *Mr. de Smidt.*] What was the nature of the rock that prevented you going down further ?—Dolerite.

189. *Mr. Pretorius.*] What is the average depth in the Middelburg and Colesberg districts ?—Between 16 and 50 feet. The strongest water has mostly been tapped in the Middelburg district between 16 and 50 feet.

190. Do you consider that the bores you have put down in various places have been a success ?—Not all.

191. To what do you attribute that ?—The formation at the places where water was not found contained too many intrusive dykes and other igneous rocks, and also layers of pot-clay, which is impervious to water.

192. Do you think it would be a good thing if the Government had a water-finding expert who should visit certain spots and have bore holes sunk ?—Yes.

193. Are the foremen employed always competent men, do you think ?—Yes, to work the drill, but all of them have not sufficient knowledge of geology to select sites for boring.

194. What is the date of your appointment ?—I was appointed Assistant Inspector on the 25th of March, 1889. That appointment was cancelled, and then I was appointed Inspecting Foreman.

195. *Mr. van Rhyn.*] Was the boring referred to by you all conducted under your supervision ?—Yes.

196. Were the holes all bored on Government ground or on private property ?—All on private property.

197. *Mr. de Smidt.*] Have you attempted to pierce the dolerite at all ?—Yes.

198. With success ?—No. The only time I did try to pierce the dolerite was in the Hay Division, I think 40 feet or so, and from that depth the bore hole was abandoned ; it was too expensive.

199. In boring, have you found that the drainage from the bore holes has lessened the flow of the springs at lower levels ?—Yes, that has happened in a couple of instances.

200. As a rule, have the farmers a knowledge of the spots where water is to be found by boring ?—Yes, some of them have a very good knowledge.

201. Are you guided by the opinion of the farmers as to where water will be found ?—Yes. I may say that the advice of the owner of the ground is always asked, because he is thoroughly acquainted with every inch of it, whereas the foreman who comes on the farm is not.

202. *Mr. van den Heever.*] Is it a fact that you have made certain recommendations which led to a more able man taking your place ?—I may say that the position I hold as Assistant Inspector

was taken by a man who was appointed Assistant Inspector before me, and who was then Acting Inspector, before the Inspector of Water Drills was appointed.

203. *Chairman.*] Are you in favour of deep-well boring on the whole ?—Yes, I am in favour of it between 60 and, say, 500 feet, but I think at a lower level it is almost useless, because it is too expensive for the farmers.

204. You do not call 500 feet very deep boring, do you ?—No ; it is shallow boring.

205. You said just now that at Doornhoek, where you got 180,000 gallons a day, the water gradually dwindled down to nothing, and you attributed that to severe droughts ; have you had rains there since that time ?—Yes.

206. And is this bore hole flowing again ?—It sometimes starts flowing again, but not so strongly as it used to.

207. Still, it is flowing, is it not ? Yes, at times, when there is a lot of rain, it starts flowing again, but then it stops. My opinion about such water is, that it may have from time to time accumulated and been dammed up, and having no outlet, the dolerite acted as a dam wall, so to speak, and when this was emptied, after being pierced by the bore hole, the supply became so weak that it subsequently stopped flowing.

208. Were any steps taken to store that water, or was it allowed to run away night and day ?—I believe the farmer constructed a dam to catch it.

Mr. van der Walt, M.L.A., examined.

209. *Chairman.*] You are a member of the Legislative Assembly ?—I am.

210. Have you had much experience in diamond boring ?—Yes, for several years.

211. Will you give the Committee the result of your experience and any information that you think would be useful ?—As far as my own district is concerned, I may say that I had a man boring there for water, and he remained in the division for thirteen months. He was a man of considerable experience, and could work the drill, set the diamonds, and so on; indeed he had a thorough knowledge of everything that was required, and could tell the exact spot where to bore for water. So long as this man was working, the boring was always a success, with small exception. In eight places out of eleven he got water. I would strongly recommend that the Government should have a man whose sole work it would be to make a study of finding out places where boring could successfully be carried on. He should be a good man, and a specialist. I may say that I know such a man, named Rogers. He has worked for many years, always with great success, but I am sorry to say he is not any longer in the Colony, having gone to the Free State. It would be a great advantage to this Colony if he were to return.

212. Suppose the Government got more drills and made the cost of boring more reasonable for the farmers, do not you think it would be a good thing for the country ?—Yes, a very good thing, but you must have a man to point out where water is to be found.

213. Are you in favour of the Government doing everything in its power to encourage boring for water ?—Yes.

214. *Mr. Pretorius.*] Are you of opinion that the first holes you bored were too small ?—Yes, that is my experience.

215. Have you found the water to disappear after a time ?—No. When the weather is very dry the water has sunk, but not disappeared altogether. It does so on my place in time of drought, as a rule.

216. I take it that you consider the foreman in charge of the drills should be thoroughly competent ?—Yes. I may say that on my farm I have got a bore hole from which water rises about two feet above the surface of the ground. I only allow it to run when I want to use it. At other times, I stop it up.

217. *Mr. de Smidt.*] Have you known instances where bore holes have weakened the springs in the neighbourhood ?—Yes ; I know of one instance, but that was quite close to the spring.

218. *Mr. van den Heever.*] If the Government were to provide a good engineer, would it be an advantage to the Colony, and cause a great saving of money ?—Yes.

219. *Mr. de Smidt.*] Is it the duty of officers to get the opinion of farmers in the matter of boring for water ?—Yes.

220. *Mr. van Rhyn.*] You think it would be a great benefit to the Colony if Mr. Rogers could be induced to come from the Free State?—Yes ; he is a most excellent man in all respects, and he is always successful.

221. *Mr. Pretorius.*] Are you of opinion that equally as good a man is to be got ?—There may be, but I formed a high opinion of him. Of course he must have other men to work under his supervision.

ANNEXURE TO APPENDIX.

[A.]

Arderne's Chambers,
133, Longmarket Street,
Cape Town, September 6th, 1899.

The Honourable J. D. Logan Esq., M.L.C.,
Chairman to the Select Committee on Water Bores.

SIR,—In accordance with the request expressed by the Honourable the Select Committee on Water Bores this morning, I have the honour to submit herewith for your information a list of bore holes put down by my firm, detailing results thereof, within the last twelve months.

In further obedience to your instructions that I should submit any suggestions for future operations other than those made by me in my evidence, I would respectfully beg to comply therewith as follows:

1. That holes of not less than three inches in diameter and not necessarily, except in very special cases, to exceed six inches in the rock be bored.
2. That all existing hand-power two inch drills be replaced, as soon as possible, by drills capable of boring a three inch hole and of reaming such hole to 4½ inch or 6 inches as may be required or found necessary.
3. That competent foremen be employed and suitably remunerated.
4. That in the event of the Government not seeing its way to accept the system of charging by results, as already suggested by me; or even in any case, that results obtained by boring on *bona fide* farms, by private firms or enterprise, subsidised in some manner either:
    - (*a*) By paying a sum per foot bored, according to the diameter of the hole, or
    - (*b*) By granting free or reduced transport for all gear, supplies and operators by rail, and in the event of the erection of windmills, a reduced rail rate for all pumping appliances.

Of course the granting of the subsidy would only be extended in the event of a successful bore-hole yielding, say, not less than at the rate of 10,000 gallons of water per 24 hours by pumping or flowing; also to be subject to a favourable report of a Government Inspector upon the work, made upon an inspection of the hole, say, three months after completion of the same.

The private firms would probably guarantee a minimum supply, to be agreed upon, and in the event of no water, no remuneration would be asked for. At least, my firm is prepared to do this, and furthermore we would undertake to do the work at a reasonable rate to be approved of by the Government.

I do not anticipate that it will be necessary to sink beyond 400 feet, and in many, by far the majority of cases, the water will be struck within 200 feet of the surface.

What is required, and what I have always urged, is that shallow holes of a large diameter be bored. Anything under 500 feet in depth cannot, even with the utmost stretch of imagination, be called "Deep Boring." My humble opinion is the "Deep Boring" will never prove satisfactory in the country, if the idea be that by such work many huge supplies, such as are found in Queensland, flowing up to millions of gallons per diem, will be discovered. Rather let the money be spent in developing the shallow supplies.

Finally, I cannot too strongly, but respectfully, urge upon the Government to in every way assist private enterprise in the direction of water-boring, as it stands to reason that those entering upon such an undertaking will do their utmost to make the thing a success, especially as the remuneration would be by results.

I have the honour to be,

Sir,

Your obedient Servant,

HARRY SAUNDERS.

Results of Bore-holes put down by Messrs. SAUNDERS & OAKLEY within the last twelve months.

	Diameter. Inches.	Depth. Feet.	Estimated Result per 24 hours. Gallons.
1. The Ohlsson Co. Brewery, Newlands	7	190	100,000 flowing.
2. D. Mills & Sons, Darling-street, Cape Town...	5	95	36,000 pumping.
3. Tramway Co., Toll, do.	6	103	41,000 ,,
4. H. Kamp, Woodstock...	6	65	50,000 ,,
5. J. Sanderson, do.	6	95	50,000 ,,
6. Private property, Roeland-street, Cape Town	5	117	20,000 ,,
7. Do. do. do.	3	92	15,000 ,,
8. Do. Hof-street, do.	5	80	22,000 ,,
9. Do Breda-street, do.	3	198	10,000 ,,
10. Do. Rondebosch	4	150	13,000 ,,
11. Do. Wynberg	5	87	10,000 ,,
12. Do. Salt River	3	27	12,000 ,,
13. Do. do.	3	65	10,000 ,,
14. Do. do.	3	57	10,000 ,,
15. Do. do.	3	155	10,000 ,,
Total	...	1,576	409,000

In every case the water can be used for domestic and other purposes.

HARRY SAUNDERS.

APPENDIX B.

ESTIMATED COST OF OPERATING GOVERNMENT DRILLS REDUCED TO WORKING DAY FOR THE YEAR 1903.

NOTE.—The working day to which all the figures have been reduced is the working day charged for under the Regulations issued in the last Notice, No. 837 of November, 1902, which consists only of a day during which the drill is actually working, and not any time when the Machine is under repairs or delayed for want of gear, lining tubes, coal or diamond crowns, consequently a calculation of additional daily sums has been made such as will cover expenses and fairly represent the cost of running the drills on the working days the applicant pays for.

HEADS.	Sullivan Drill working 24 hours per diem.	Sullivan Drill working 12 hours per diem.	Steam Drill working 12 hours per diem.	Steam Percussion Drill working 12 hours.	Combined Diamond & Jumper Drill working 12 hours per diem.	Hand and Horse-power Diamond Drill working 12 hours per diem.	REMARKS.
Foreman	£1 10 0	£1 10 0	£0 14 0	£1 0 0	£0 12 0	£0 12 0	Foremen and Enginemen are paid at monthly rates, including working days, idle days and Sundays.
Assistant Foreman ...	2 0 0	1 0 0	...	0 15 0	...	...	
Crown Setter	2 0 0	1 10 0	...	...	...	...	
Engineman	0 14 0	0 7 0	0 5 0	...	...	...	
Diamonds	2 10 0	1 10 0	0 15 0	...	0 15 0	0 15 0	
Renewals and Repairs ...	0 15 0	0 10 0	0 7 6	0 7 6	0 6 6	0 6 6	Each Sullivan Drill requires a Crown Setter.
Stores	0 5 0	0 4 0	0 3 0	0 2 6	0 2 0	0 2 0	
Railway Transport ...	0 5 0	0 4 0	0 2 6	0 3 0	0 1 6	0 1 6	
Delays and Accidents ...	0 4 0	0 4 0	0 3 0	0 2 0	0 2 6	0 2 6	
Administration	0 7 6	0 7 6	0 6 0	0 6 0	0 6 0	0 6 0	This only includes Staff of Boring Branch.
Amount expended under Vote for Water Boring	£10 10 6	£7 6 6	£2 15 0	£2 16 0	£2 5 6	£2 5 6	
Less Applicants' Contribution under Notice, 19 Nov., '02	4 0 0	2 15 0	1 0 0	1 0 0	0 12 6	0 12 6	
Amount of Public Funds expended for Water Boring	£6 10 6	£4 11 6	£1 15 0	£1 16 0	£1 13 0	£1 13 0	
Labour	£1 4 0	£0 12 0	£0 6 0	0 6 0	0 10 0	0 10 0	The difference between the cost of employing 2 labourers and 1 horse in the place of 5 labourers is hardly appreciable.
Fuel	1 0 0	0 15 0	0 4 0	0 5 0	...	...	
Water for working Drill...	0 10 0	0 5 0	0 2 0	0 2 0	0 1 0	0 1 0	
Transport by Waggon	0 6 0	0 5 0	0 4 0	0 3 6	0 3 0	0 2 6	
Contribution to Government	4 0 0	2 15 0	1 0 0	1 0 0	0 12 6	0 12 6	
Cost per diem to Applicant	£7 0 0	£4 12 0	£1 16 0	£1 16 6	£1 6 6	£1 6 0	

The net cost of boring to the Government for each class of drill is underlined, while the net cost to the Applicant is underlined double.

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